

DECEMBER 15, 1947

Engineering Library

AUTOMOTIVE INDUSTRIES

The Industrial News Authority Devoted to Automotive Products for Land, Air & Water

Want all work
and no play in
your automatic
transmission?

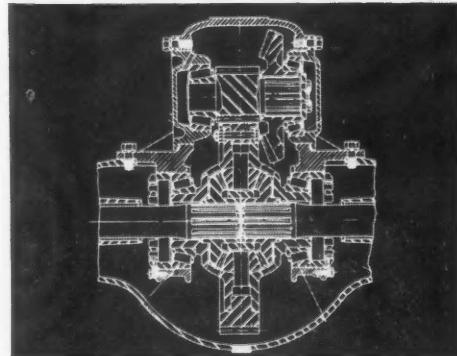
YOU can insure your automatic transmission against "wobble" by using Timken tapered roller bearings on the undershaft.

Timken bearings hold the countershaft rigid alignment, eliminating deflection and end-movement. Gear teeth are kept closer mesh. And you're sure of longer transmission life because there's less wear on parts.

With Timken bearings on the countershaft, designs can be simplified. No special thrust bearings or washers to bother out because Timken tapered roller bearings take both radial and thrust loads. Tapered design also permits precise adjustment during installation—machining clearances of surrounding parts don't need to be as close.

Add it all up and you'll see why Timken

bearings will help deliver years of smooth, quiet, trouble-free performance at minimum cost.

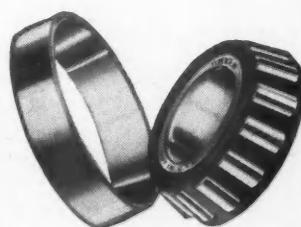


LOOK AT DOUBLE REDUCTION AXLES FOR EXAMPLE... In scores of automotive applications such as this, Timken tapered roll-

er bearings have long since proved their ability to take the tough loads in any combination. When specifying bearings remember that the Timken Company has been the acknowledged leader in the automotive industry for almost fifty years due to 1) advanced design, 2) precision manufacture, 3) rigid quality control and 4) special analysis Timken steels.

Feel free to call upon our engineering facilities when planning new bearing applications. In Detroit, phone MADison 1380. The Timken Roller Bearing Company, Canton 6, Ohio.

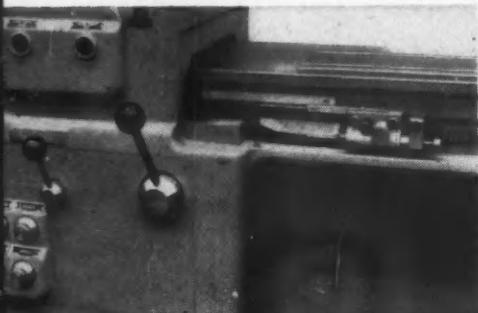
NOTE TO P. A.'S. Because every step of the manufacture of Timken bearings is controlled within our company... because our vast manufacturing facilities are widely dispersed... you will find the Timken Company a supply source of outstanding reliability.



NOT JUST A BALL ○ NOT JUST A ROLLER ○ THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL ○ AND THRUST → ○ LOADS OR ANY COMBINATION → ○



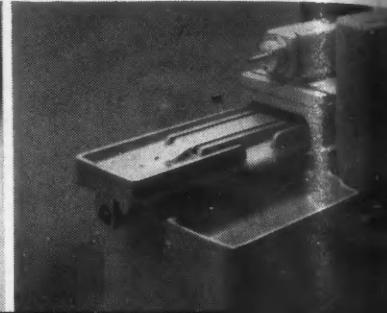
Compact design means simple operation



Centralized controls and easily
adjusted table dogs



Complete power unit detachable
from base



Large chip pan and built-in
electrical control box

on the NEW SMALL HEALD BORE-MATICS

**Single or double end high-precision
machines for small work**



SMALL IN SIZE and simple in design, these new Bore-Matics are ideally suited to both large and small shops. They can be tooled for one or several parts to bore, face, turn, chamfer groove or fly cut — yet they operate very easily.

Among the features in design are: knee-hole construction; capacity for two spindles at each end; complete control of heat and vibration; permanently lubricated, cool-running boringheads; self-adjusting, quick acting brakes; leakproof hydraulic system — all of which require negligible maintenance.

These new, small Bore-Matics are extremely accurate, productive and efficient with —

EXTREMELY FAST OPERATING CYCLES — high table traverse speeds, and faster boringhead speeds.

UNIFORM SPEEDS AND FEEDS — remain constant throughout the day without adjustment.

TWO-WAY BORING — different rates of "in" and "out" feeds available.

Write Heald branch office nearest you for further information.

FREE BULLETIN on these new Heald No. I21 or I22 Bore-Matics lists complete features and specifications. Send for your copy today.



THE HEALD MACHINE COMPANY, Worcester 6, Mass.

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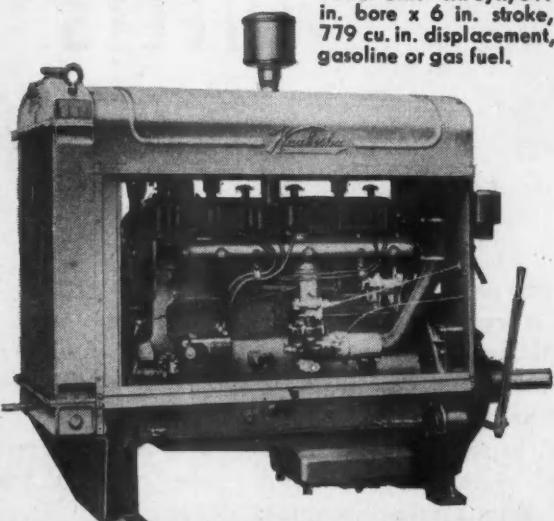


REMEMBER THIS?



The Roto Wing Snow Plow's rapidly revolving 3-bladed, wing rotor is driven by a 145-GKU Waukesha Power Unit.

145-GKU WAUKESHA
Power Unit—six cyl., 5½ in. bore x 6 in. stroke,
779 cu. in. displacement,
gasoline or gas fuel.



January 29, 1947

Milwaukee Journal Photo

● Look out for Old Man Winter! Put Waukesha power behind your snow removal equipment. Keep those streets and highways open! The snow plow shown is a Roto Wing. Waukesha powered, it goes through 2-3 ft. drifts throwing snow at 20 m.p.h. On the highways it cuts deeper than 3-ft. snow banks back 5 ft. beyond the road shoulder.

And what a power plant it has! The Waukesha 145-GKU—a six with the utmost power output and dependability *built in!* With a husky 7-bearing, 3½ in. crankshaft... hard alloy exhaust valve seat inserts... removable wet sleeve cylinders... gear driven oil and water pumps... precision bearings... Waukesha built-in governor.

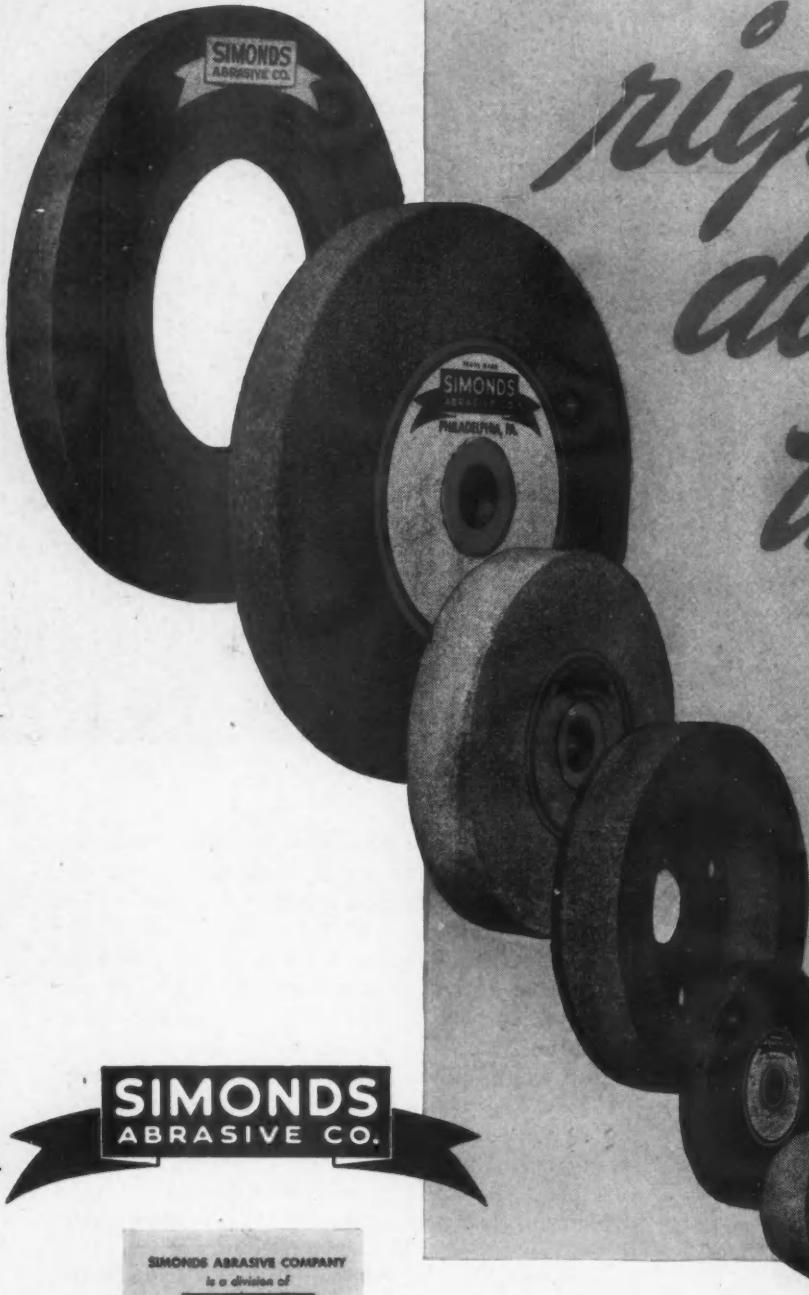
And speaking of dependability... this snow plow is traveling on a Walters Truck powered with a Model 6-WAK Waukesha, *the engine for super trucks and buses.*

Bulletin 1186 tells you about the snow plow's power unit... Bulletin 1138 the truck engine. Send for them.

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.
NEW YORK • TULSA • LOS ANGELES

WAUKESHA ENGINES

EFFICIENCY . . .



*right
down
the line*

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WHEELS**

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AUTOMOTIVE INDUSTRIES

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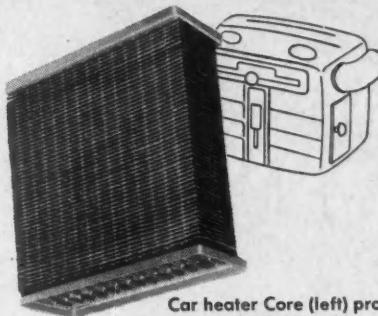
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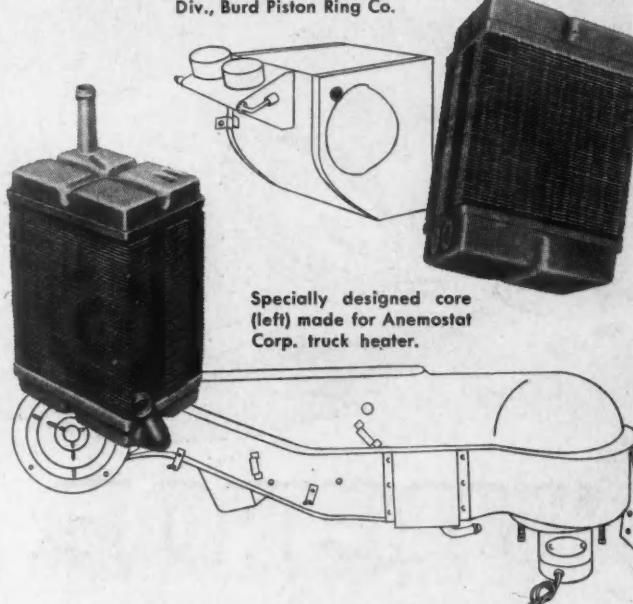
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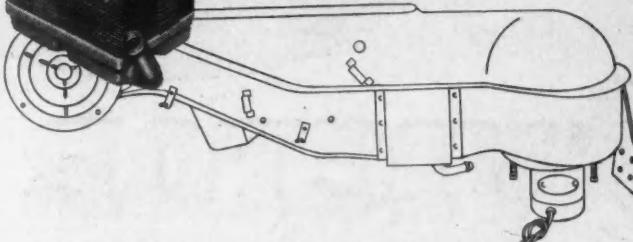
YOUNG PIONEERS in Car Heater Cores



Car heater Core (left) produced for HaDees Heater Div., Burd Piston Ring Co.



Specially designed core (left) made for Anemostat Corp. truck heater.



Young all-copper cores have been in constant demand by manufacturers of quality car heaters and were used in the first hot water car heaters built by Tropic Aire in 1929. They have continued to be used since by leading manufacturers because they provide maximum heating efficiency, simplicity of design and trouble-free maintenance. Young now furnishes cores for recirculating type heaters as well as the increasingly popular fresh-air types . . . for such outstanding units as the HaDees, Evans, Anemostat and others. If your product requires a core or radiator of standard or specialized design, consult Young Engineers for a careful appraisal of your particular heat transfer problems.

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**Perfect
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...is achieved by careful consideration of radii describing holes, gauge of metal and thickness of gasket, based on Victor's experience.

**Accurately Cut
with Steel Dies**

...made by Victor's skilled tool and die makers, Victor gaskets are uniform and fit perfectly as original or replacement part for the engine.

**Exact
Dimensions**

...which conform to all manufacturers' specifications are followed in producing gaskets that line with motor block openings and studs.

VICTOR

The Greatest Name in the Gasket Industry

...has been built through years of painstaking research, craftsmanship and attention to manufacturing detail. As compression ratios of auto motors increased, with corresponding increases in pressure and temperature, Victor began to produce their own Asbestos Millboard. Experience has enabled them to develop accurate tables for computing perfect overlapping. And, since all gasket dies are produced by Victor craftsmen, accurate fitting is assured.

Victor's experience, research and production facilities are available to you. We welcome the chance to study your problem. VICTOR MANUFACTURING AND GASKET COMPANY, Box 1333, Chicago 90, Illinois.

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OUR CUSTOMERS"

George Westinghouse

MUSKEGON
Piston Ring

"The world's greatest engineer" of his time, inventor, financier and pioneer in countless industrial fields, George Westinghouse made service to his customers his lifelong policy.

This also is the policy of Muskegon Piston Ring Co., and it has been clearly stated in the following words: *"It is Muskegon's firmly established policy to sell exclusively to manufacturers (1) for installation as original equipment and (2) for resale for service purposes."*

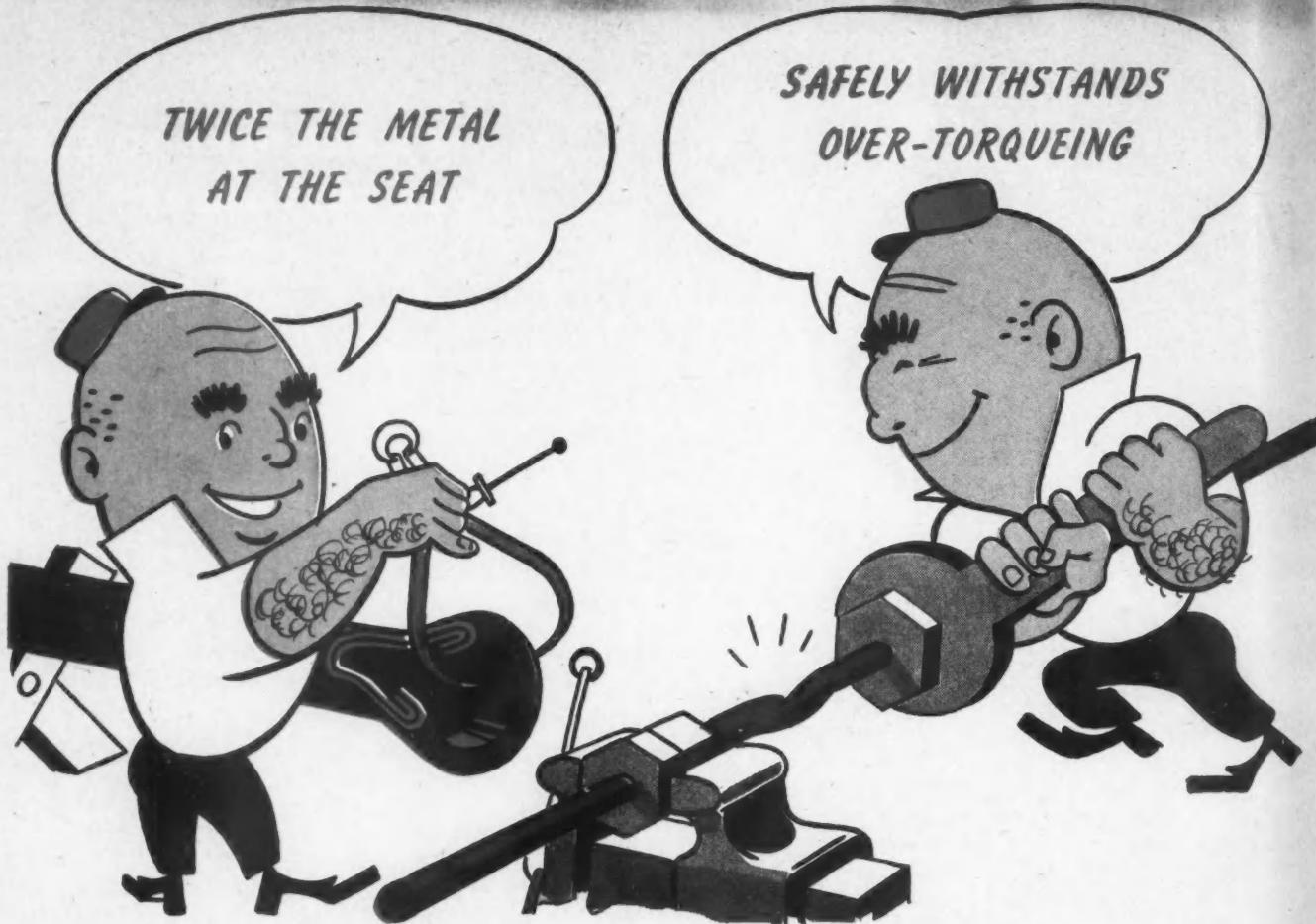
Look to a company's policy to tell you what you can expect in the way of performance and service.

MUSKEGON PISTON RING CO.

MUSKEGON, MICHIGAN

Plants at Muskegon and Sparta

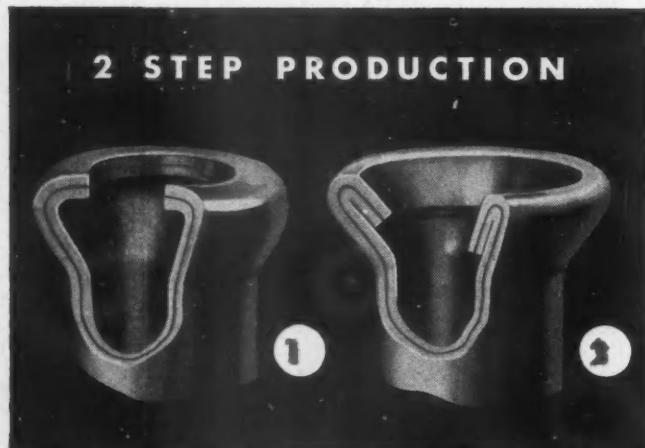
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Assures leakproof, pressure-proof joints

TUBING BUYERS who want super-strong joints should get a good look at the Bundy double flare.

You can see why this flare is superior. It is Bundyweld*



Leakproof, pressure-proof joints are assured by Bundy double flare. Frequent removals and replacements of fittings are also possible. This flare is made by hand or machine tools to accommodate any standard fitting.

Tubing formed to double thickness at the seat, and always held to close tolerances.

The result is added strength to overcome stresses due to over-torqueing, high pressure or excessive vibration. With Bundy double flare, joints are leakproof and pressure proof.

10 million a month

Up to 10 million double flares a month are produced by Bundy. It has proved its worth in more than 16 years of usage. Furthermore, it has been adopted as a standard by the Society of Automotive Engineers.

But that isn't all about Bundyweld!

Stove makers, Diesel engine manufacturers, makers of refrigeration and cooling device equipment, and many other manufacturers have picked Bundyweld Tubing with its unique, double-wall construction.

Are you on the hunt for superior tubing? Investigate Bundyweld. Available in steel, Monel and nickel. Call or write *Bundy Tubing Company, Detroit 14, Michigan.*

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FASTER FINAL ASSEMBLY

because the separable bearing parts are fully interchangeable

One of the important design advantages of Hyatt Roller Bearings is pictured here—in action.

The shafts, with gear and bearing roller assembly, were pre-assembled in another part of the shop. The bearing outer races were previously installed in the housing. As the sub-assemblies meet here, any roller assembly will fit any outer race; no selection or matching required. This Hyatt feature speeds final assembly, permits more efficient production planning and layout, and often leads to improvements in product design.

And this is but one of the advantages enjoyed by designers who know the Hyatt Hy-Load line. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J., Chicago, Detroit, Pittsburgh and Oakland, California.

Photo Courtesy
Caterpillar Tractor
Company



HYATT ROLLER BEARINGS

We've made the "ROUNDS" for 60 years

*Perhaps OUR experience
can help YOU!*

Yes, for more than a half century, Gisholt has specialized in the field of round and partly round parts . . . building equipment to produce them . . . helping others to use it most efficiently.

Gisholt engineers concentrate on these machine shop problems, visiting hundreds of plants each year to help solve hundreds of problems. They will gladly help you.

If you have operations in your plant which you think might be improved, we invite you to make use of this experience through the Gisholt Round Table—a clearing house for practical ideas.

Now, and in the years ahead, more emphasis than ever will be placed upon better methods, increased efficiency and lower costs. Be sure you have the best methods and equipment. It pays to "Look ahead—keep ahead—with Gisholt."

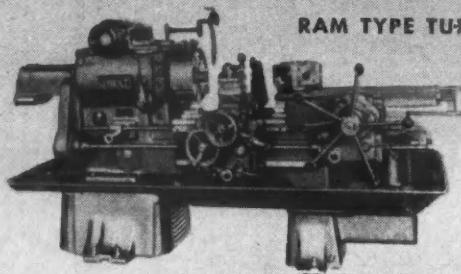
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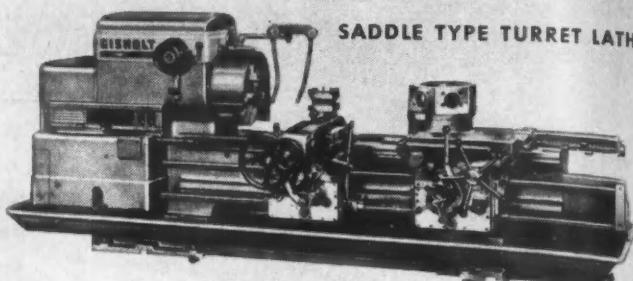
The GISHOLT ROUND TABLE

represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

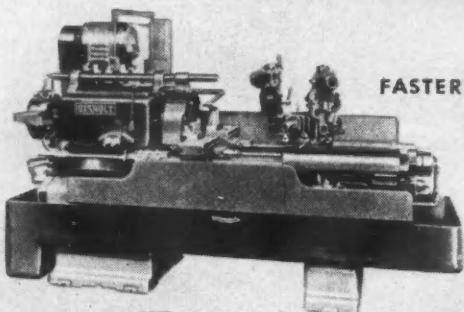
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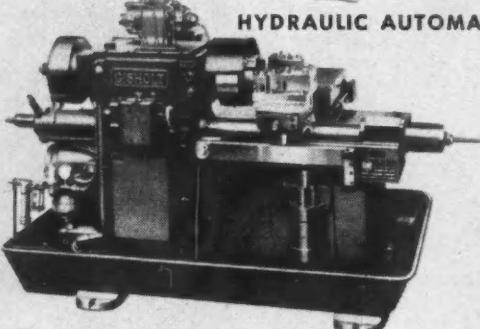
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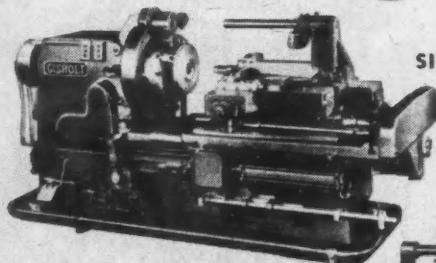
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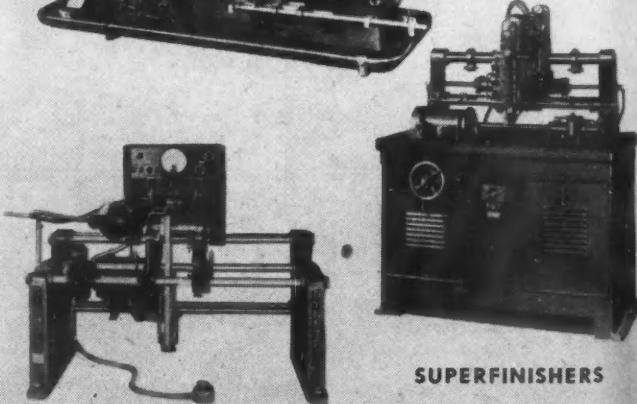
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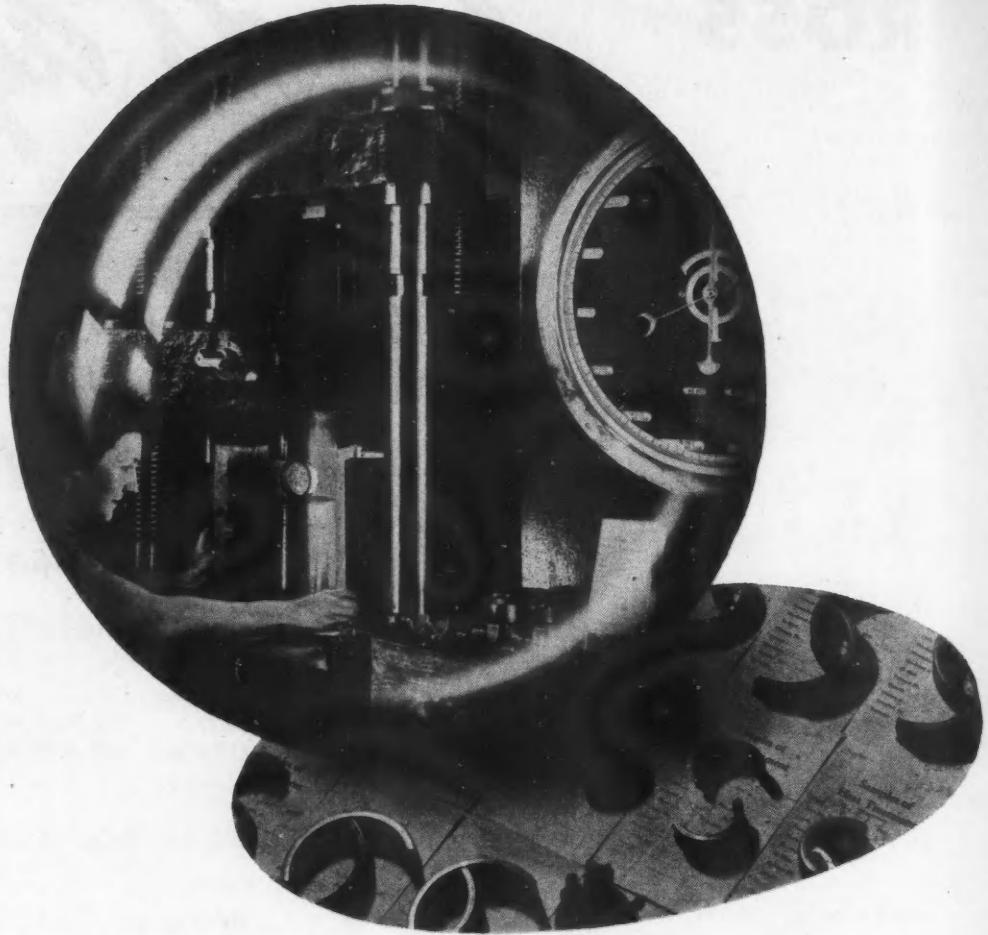
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These bearing parts are part of a day's vital statistics in Federal's "bureau of standards." Here race rings and balls are crush-tested after hardening to determine their load bearing strength, etch tested for any minute cracks in the fracture and Rockwell checked for hardness.

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tells the "inside" story in inspection; performance proves it.

Every fourth operator is an inspector at Federal during the more than 100 individual manufacturing, inspection and cleaning operations that go into every Federal Bearing.

There's a size and type that fits your application in the Federal line. Our Catalogue "K" describes them all. May we send you a copy?

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CENTERLESS ground and lapped to a standard surface finish of 5 Microinches RMS, Permite Piston Pins measure up fully — and then some — to their high responsibility in the new automotive, industrial and marine engines. The carefully maintained quality of these vital little links of power transmission makes Permite Piston Pins first choice among leading engine builders and manufacturers of cars, trucks, buses and tractors.

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The better engines of today are being built for longer life than ever with Permite Piston Pins — and other Permite hardened, ground and forged Steel Parts. Permite engineers, with their modern development and production facilities, are at your service.

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Power Braking

A Problem?



...put it up to

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BUILDER OF THE WORLD'S MOST WIDELY PROVED POWER BRAKING SYSTEMS

When you come to Bendix* Products with your power braking problem, you are really coming to headquarters, because Bendix Products has equipped more vehicles with power braking than any other manufacturer. Not only that, you get an unbiased answer because Bendix Products

builds more different types and sizes, and recommends to the requirement rather than to what is available. Take your problem to the leader—Put it up to Bendix Products.

BENDIX PRODUCTS DIVISION of
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HYDROVAC* POWER BRAKING

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HYDRAULIC POWER STEERING

WHEEL BRAKES

*REG. U. S. PAT. OFF.

OVER 7 OUT OF 10 AUTOMOTIVE VEHICLES EVER BUILT HAVE BEEN BETTER BECAUSE OF BENDIX

• BUILT BY FITZJOHN COACH CO.



They're Standard on Fitzjohn Duraliners!

The jerks and jolts imposed upon the propeller shaft . . . the chassis weave and frame distortion resulting from heavy passenger loads over cracked pavements and rough detours . . . are reasons why bus manufacturers prefer the SKF Self-Aligning Propeller Shaft Box such as used on these new Fitzjohn Duraliners. Sturdy, long-lived bearings with built-in alignment

that compensates for chassis weave and distortion, SKF Bearings assure low mileage costs, maintained schedules, and stepped-up profits. Naturally, the more performance you get from bearings, the greater the profits you derive from buses.

6356

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D

Published on the first
and 15th of the month

December 15, 1947
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Some High Spots of this Issue

Philips Air Engine

Compact, light and highly efficient, the Philips air engine has neither spark plugs nor distributor, and can use practically any kind of fuel. Developed by N. V. Philips in Holland, the new engine operates on the principle that work can be obtained from the expansion and compression of air. Advantages include low wear, little noise, uniform torque, and low consumption of lubricating oil. A thorough description of this revolutionary engine is presented on pages 24-28.

New 1948 Hudsons

The new 1948 Hudsons feature completely different styling with full-width bodies and lower center of gravity, the latter obtained through the introduction of their "Monobilt" body and frame construction. Complete details on the Super-Six and Super-Eight models are described by Detroit Editor Joseph Geschelin, beginning on page 82.

British Jet Engines

Several interesting manufacturing operations on three British jet engines—the Nene, the Derwent V and the Goblin—are illustrated in a series of photos on pages 36 and 37.

Precision Castings

A comprehensive discussion of the various methods of precision castings, covering natural bonded sand, precision sand, synthetic baked sand, Antioch, lost wax, permanent molds, die casting, centrifugal molds and vacuum poured castings, is given by R. H. Osbrink, president of the Osbrink Manufacturing Co., on pages 38, 39 and 40.

Styling for the Future

Leonard Westrate, AI News Editor in Detroit, tells what lies behind the advanced styling of General Motors cars. His article, on pages 42 and 43, describes the organization of GM's styling section, and shows how the automobile of the future originates in the design studio of today.

24 New Production Equipment and New Product Items And Other High Spots Such As:

Economic problems in Europe, as seen by George Romney, managing director of the AMA; massive presses in use at Kaiser Fleetwings, Bristol, Pa., for stamping out deck lids for Kaiser and Frazer cars; sectional drawings of the new Packard Custom eight; and current automotive patents issued.

**Comprehensive Interpretation of News of the Industries, Page 17
For Complete Table of Contents, See Page 3**

**AUTOMOTIVE
INDUSTRIES** —————

Reg. U. S. Pat. Off.



Taking the Distance Out of Your Steel Problems

Urgently needed by a Los Angeles engineering company, was a large shipment of stainless steel pipe in a special size. A call to the Ryerson plant in Los Angeles disclosed that the required pipe was not in Los Angeles stock, but *was* on hand in another city.

Ryerson Los Angeles immediately phoned Ryerson in Chicago. Could Chicago supply the desperately needed pipe? Chicago could—and did! The material was quickly trucked to a Chicago airport, flown to Los Angeles, and delivered at the customer's plant the following morning, less than 24 hours after the order was received.

That's how Ryerson—when the steel *is* available—can take the *distance* out of your steel problems. That's how the twelve closely cooperating plants of the Ryerson Steel-Service System often accomplish

the seemingly impossible in an incredibly short time. And that's the sort of far-reaching service you can look for when you contact any Ryerson plant for any steel requirement.

Joseph T. Ryerson & Son, Inc. Plants at: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles.

PRINCIPAL PRODUCTS

Bars—hot and cold rolled alloy steel reinforcing	Mechanical Tubing Boiler Tubes and Fittings	Tool Steel Wire, Chain Bolts, Rivets
Structurals	Allegheny Stainless— sheets, plates, shapes, bars, tubing, etc.	Babbitt
Plates— Inland 4-Way Floor Plate	Sheet and Strip Steel	Metal Working Tools & Machinery, etc.

RYERSON STEEL

NEWS

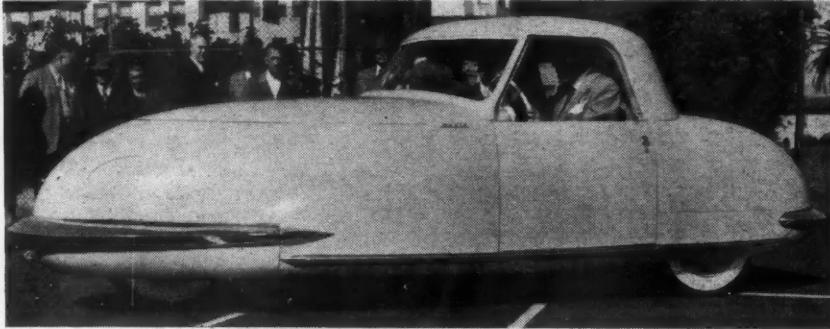
of the AUTOMOTIVE INDUSTRIES

Car & Truck Output Close to Five Million Units for 1947

With only two weeks to go it is now certain that the combined car and truck production of the U. S. and Canada will hit five million this year. Although November total production was about 41,000 below the October figure, daily production was higher since there were four fewer working days in November than in October. At the end of the first full week in December, combined production stood at an estimated 4,670,000, leaving 330,000 to go for the remaining 17 working days. This would mean that production would have to average roughly 20,000 a day, which is slightly below the average maintained for the previous three weeks. However, complicating factors may arise from unexpected shortages of sheet steel or decisions to close for a few days to take inventory. Most plants are now planning to work the day following Christmas and also the three days preceding New Year's Day. Little difficulty is expected from absenteeism since under the terms of union contracts governing paid holidays, employees must work the day before and the day following a holiday in order to qualify for payment.

Ford Completes First Postwar Assembly Plant

The first of four new Ford assembly plants has been completed and will go into operation soon at Hapeville, Ga., near Atlanta. The plant will be used for Ford car and truck assembly, supplying Georgia, Alabama, Florida and part of Tennessee. Passenger car assembly will not start until next spring. The plant contains more than 586,800 sq ft of floor space and has a production capacity of 350 vehicles a day. Cost of the plant is set at \$6 million with an additional million dollars spent for tooling. Included in the equipment are 4.5 mi of overhead conveyors and 1.25 mi of various type floor conveyors to reduce manual handling of equipment to a minimum. Spray booths are of the latest down-draft type, costing \$60,000 each, as compared to \$5000 for the old type. Bonderizing systems for both the passenger cars and trucks have been installed.



Three Wheeling

Balance, stability and maneuverability characterize the new three-wheeled Davis passenger car, according to the Davis Motorcar Co., Van Nuys, Calif., which has scheduled production of 50 cars a day in early 1948. The 1385-lb car is powered by a four-cyl Hercules engine reportedly developing 60 hp and providing a top speed over 100 mph.

Studebaker Buys Empire Steel

Studebaker Corp. has purchased the Empire Steel Corp. of Mansfield, O., for \$7,034,000. The transaction is subject to approval of Empire stockholders. The steel company has an annual capacity of 348,000 tons of steel ingots and 120,000 tons of hot rolled annealing sheets. H. F. Vance, Studebaker board chairman, announced that the acquisition of the steel company will enable Studebaker to maintain its present production rate of close to 20,000 cars and trucks a month, and will permit the company to increase its output to approximately 25,000 units monthly much sooner than had been anticipated. He said that Studebaker will not absorb the entire output of steel at the plant at the outset, and that consideration will be given to present customers of the steel company. The Empire plant will be operated as a wholly-owned subsidiary with the present management retained.

Studebaker expects to start limited production of passenger cars in Canada some time next spring. A new plant at Hamilton, Ont., is under construction, and it is expected that it will be turning out about 60 cars a day before summer. It is expected that work will be rushed now that Canada has imposed an embargo on completed cars which will be followed shortly by a quota system permitting only limited imports. Nash also has a plant under construction in Canada,

but production there is not expected to start until late next year.

New Hudson Prices Show Increase of 11 Per Cent

Showing an increase of approximately 11 per cent, Hudson Motor Car Co. has announced prices on its 1948 model. Dollarwise, the increases range from \$177.19 to \$220.08. Prices announced are as follows: Super-Six series, two-door \$1822, up \$194.19; four-door \$1870, up \$199.19; three-passenger coupe \$1762, up \$214.94; club coupe \$1867, up \$204.31. Commodore Six series, four-door sedan \$2020, up \$207.08; club coupe \$1997, up \$196.81. Super-Eight series, four-door sedan \$1950, up \$177.19; club coupe \$1947, up \$183.81. Commodore-Eight series, four-door sedan \$2100, up \$220.08; club coupe \$2077, up \$217.81.

Tucker Prepares For Production in Spring

During recent weeks considerable activity has been in progress at the Tucker plant in Chicago in preparation for the start of production early next spring. More than 18,000 machine tools and other pieces of heavy equipment have been shifted to make way for assembly lines and more than 10,000 ft of conveyor have been moved, clearing more than 800,000 sq ft of floor space. The company

NEWS of the AUTOMOTIVE INDUSTRIES

has acquired a complete paint line which is now being installed. Several hundred more employees have been recently added to the payroll.

Paul G. Wellencamp has been named engineering manager of Tucker Corp. He was formerly engineering operating manager for Fairchild Engine and Airplane Corp. and also served with Willys-Overland and American-Lafrance.

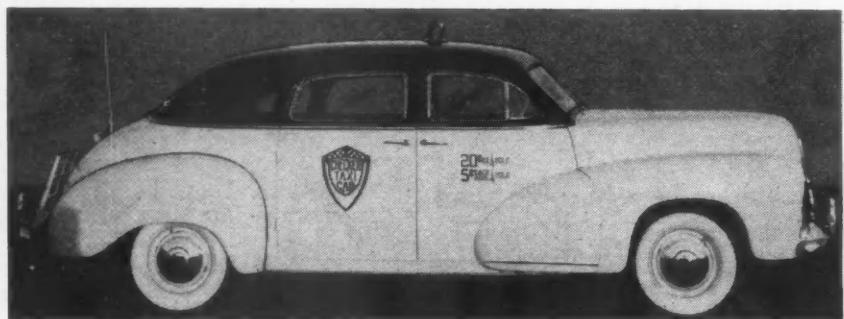
Checker Cab Starts Postwar Production

Checker Cab Mfg. Corp. will start assembly of its first postwar taxicabs very late in December. Checker expects to concentrate production at first on about 8000 cabs to fill a potential demand, and then to sell a modified version of the cab as a sales-

predicted before the Pressed Metal Institute recently, that demand for 1948 for finished steel would be about 66.5 million tons against production of approximately 63 million tons.

Playboy Buys Chevrolet Plant in Buffalo from WAA

A \$2,259,000 bid by the Playboy Motor Car Corp. for the former Chevrolet Plant No. 1 on Kenmore Ave. in Buffalo has been accepted by the WAA, Lou Horwitz, Playboy president, recently announced. Playboy plans to tool the plant, which contains 500,000 sq ft of manufacturing space for the production of 100,000 vehicles a year on one shift, and expects to be in mass production by April.



The Latest in Checkers

The new 1948 Checker Model A-2 taxicab, produced by the Checker Cab Mfg. Corp., Kalamazoo, Mich., with seven-passenger capacity, has a wheelbase of 124 in., and an overall length of 206 in. A six-cyl Continental CF6226 engine, developing 26.3 SAE rated hp, powers the new cab.

man's car or a seven-passenger automobile. Checker was delayed in fixing its design and obtaining dies for the new model, which is about a foot shorter than the previous one without any sacrifice of passenger space. The delivery price at New York is reported to be \$2369.

Steel Industry Uneasy Over Low Scrap Supply

Steel companies are uneasy over low scrap inventories which are little more than half of the traditional safe average for this time of the year. According to estimates, present stocks of scrap are said to be equal to five or six weeks supply at the current rate of steel production. Steel producers like to have at least a 60 day's supply on hand going into the winter when scrap collections are slow because of bad weather. C. S. White, president of Republic Steel,

experimental, research and testing facilities. Serving Buick as a parts and service center until a year ago, the two-story building, with almost 260,000 sq ft of floor space, includes a complete machine shop, a miniature sheet metal plant, a complete set-up for building chassis, and forge, pattern, paint and trim shops. In addition, there are large areas for car and important component assembly, a dynamometer section, a transmission laboratory, improved garage facilities for test car check, and a long-range development room.

Ford Using Aluminum For Steel in 12 Items

In the face of the continuing sheet steel shortage, all automobile manufacturers are intensifying their efforts to replace sheet steel parts with aluminum. Ford has made considerable progress in this direction and already has a dozen or more substitutes incorporated into the current model. These include the running board, headlamp body, rear bumper stone deflector, front fender brace, radiator air shield deflector, air duct from front radiator to cross member, cowl ventilator cover, floor board front panel, hot water heater case, hot water heater duct assembly, hot water heater deflector, and the duct from radiator grille to radiator shield. It is estimated that the savings amount to about 50 pounds of steel a car, which would amount to a sizable total when applied to a year's production.

One problem that will confront Ford next year when entirely new models are brought out will be an adequate supply of replacement parts for millions of current and previous models which will still require service for several years. The new models will be so totally different that very few if any of the present parts will be used on a replacement basis. Ford is planning to continue manufacture of replacement parts and has commitments with suppliers also to continue. It is reported that the company will not attempt at this time to estimate all-time requirements and then attempt to produce that number of parts and cease production. For one thing the necessity of producing a high volume of replacements for previous models and at the same time stocking dealers with parts for new models will require a considerable amount of steel. Ford will use the aircraft building at the Rouge for parts and accessories warehousing and will not move the operation to the Mound Road Naval Arsenal, as originally planned.

NEWS of the AUTOMOTIVE INDUSTRIES

Graham-Paige Nets \$388,646 For First Nine Months of '47

Contrasted with a net loss of \$1,473,173 in the similar period in 1946, a consolidated net profit of \$388,646 was reported by Graham-Paige Motors Corp. for the nine months ending Sept. 30, 1947. Gross sales in the first nine months of 1947 amounted to \$12,788,734, of which \$8,746,158 consisted of farm equipment sales and \$4,042,575 from automotive operations prior to the disposal of these assets to Kaiser-Frazer Corp.

The manufacturing and sales rights for two new model rototillers have been acquired by Graham-Paige from the Swiss patent holders. The two new models are a small rototiller which will have a variable cut that can be reduced to eight in., and a field-size tractor-drawn machine with a tilling width of approximately five ft. Current models, of which about 40,000 have been sold to date, have widths of 20 and 26 in. respectively.

Boost Prices Of Car & Truck Tires

Most of the major tire producers have announced price increases following the lead of General Tire and Rubber Co. United States Rubber Co. boosted passenger car tire prices between six and eight per cent and truck tire prices between five and seven per cent. Firestone increased passenger car tires an average of 6.5 per cent and truck tires 5.5 per cent. Sieberling Tire Co. raised prices of truck tires five per cent and 6.5 per cent on passenger car tires. Goodyear revised its prices upward, raising passenger car tires by 7.5 per cent and truck tires by five per cent. B. F. Goodrich up slightly more than five per cent on car tires and 5.5 per cent on truck tires. Inner tube prices, however, have not been raised by any of the companies. The general price increases are said to compensate only partially for the rising cost of rubber and fabric and manufacturing and distribution. Firestone reports that even after the increases, tire prices are still lower on passenger car and truck tires than they were before the war.

Canada Stops Automobile Parts & Accessory Imports

In explaining to Parliament the Canadian import restrictions that became effective Nov. 18 on a wide range of commodities to correct Canada's foreign exchange position, Douglas C. Abbott, Minister of

Wheel Tester

Designed and built by the Aluminum Co. of America, this wheel testing machine is capable of performing wheel fatigue tests closely approximating road conditions met by heavy-duty trucks and trailers. A calibrated spring exerts pressure on the wheel assembly, simulating loads carried, through a heavy shaft.



Finance, stated that automobile parts and accessories are banned as well as complete automobiles and motor vehicles of all kinds, including chassis for them. Other automotive items on this list of "prohibited" goods are automobile and truck trailers, passenger automobile tires, batteries, and lubricating oils.

Finance Minister Abbott declared that the Canadian automobile industry must make its own components or do without them, emphasizing that it was able to produce a large number of Army transports during the war and also parts and accessories for them. This statement was qualified by the announcement that the prohibiting of the importation of motor vehicles would be only temporary and that in the near future this complete prohibition would be

replaced by a restrictive quota system. However, he hinted that the "near future" may be a long way off.

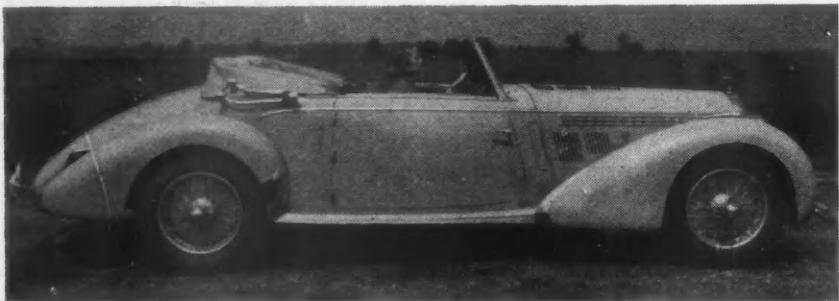
Despite the embargo, there is a faint possibility for shipment of automobile parts and accessories to Canada, according to official sources. Appeal can be made to C. D. Howe, Reconstruction Minister, House of Parliament, Ottawa, who is endowed with top authority to prohibit or restrict any metal goods not specifically included in the "prohibited" and "quota" lists. It is understood that Howe will refuse to approve requests for importation of automobile parts and accessories, which are not mentioned specifically on the two lists, but nevertheless the possibility is there for Howe to approve shipments if he sees fit, particularly in vital cases.



Towing a Boeing

Knocked down, with wings and tail surfaces removed and latched to the sides of the fuselage, the Army Ground Forces' Boeing XL-15 liaison plane can be towed up to 40 mph. This model can be reassembled and ready for flight in less than an hour it is reported.

NEWS of the AUTOMOTIVE INDUSTRIES



French Sport

This new French sports car, the Talbot, is powered by a six cyl engine of 273 cu in. displacement with 3.66 in. bore and 4.33 in. stroke. It develops 168 hp at 4200 rpm with a compression ratio of seven to one. Other features include independent suspension at the front, semi-elliptic springs at the rear, and a Wilson preselective transmission.

The list of "goods subject to quota" embraces another large group of commodities, mainly consumer goods, and is devised so that it reduces the level of imports from 10 countries, including the United States and territories, by about 50 per cent of their previous rate. It consists of hundreds of items, among which are clocks, leather and textile goods, and others of interest to the American automotive industries.

Crosley Earns \$309,563 in First Fiscal Quarter of '47

Crosley Motors, Inc., earned \$309,563 on sales of \$5,485,894 in the first quarter of its new fiscal year, the three months ended Oct. 31, 1947. A net loss of \$363,613 was reported for the comparable period of fiscal 1946-47. Car deliveries totaled 7208 during the period as compared to 5193 delivered during the previous three months. By early 1948 Crosley expects to be producing at the rate of 3000 a month, if current expansion plans continue, as at present. The appointment of 15 new dealers implements the recently announced company policy of doubling the number of Crosley dealers in the next six months.

Used Car Lot Prices Same Today As in March, 1946

Andrew T. Court, GM economist, has an interesting observation about open market prices for automobiles over the past 18 months. He points out that the average price for a 1946 Chevrolet on the used car lot in March 15, 1946, was \$1750. On Nov. 15, 1947, on the used car lot, the same car would still bring \$1750.

Truck Producers Favor Uniform Rating Method

A survey of truck manufacturers shows that a uniform method of rating, in terms of gross vehicle weight and net horsepower, is favored, according to the AMA. Truck producers beginning Jan. 1, 1948, will be prepared to rate their vehicles in these terms, and on request will file GVW and net hp ratings with state licensing authorities. A further recommendation is that after Jan. 1 before initial registration in any state or the District of Columbia, every vehicle to be used for property transportation shall permanently attach a manufacturer's identification plate showing the manufacturer's maximum GVW rating and certified net hp at specified rpm. Interestingly enough, by the end of 1947 legislative sessions, 26 states were using GVW ratings, 10 were using net weight, and 13 state weight ratings.

1948 Ryan Navion Retains Basic Design

With some 1948 model Ryan Navions in the hands of dealers, and volume production scheduled to begin in January, Ryan Aeronautical Co. has revealed the addition of new standard equipment items as well as refinements. Now provided as standard equipment is a fuel system which incorporates a reserve electric fuel booster pump for auxiliary operation, in addition to the standard engine driven pump, assuring an independently driven pump in reserve at all times. The new plane has been surfaced with a new high-gloss durable enamel finish, now standard for all Navions. Improved ventilation, reduction of noise level and more attractive upholstering and interior styling are features of the plane. Available as optional equipment, a 20-gal auxiliary tank will increase the Navion's range with four passengers to a 750 mi maximum at a normal cruising speed of 150 mph.

Pontiac Trains Dealers To Service Hydra-Matic

GM's Pontiac Motor Div. is conducting a comprehensive training program in connection with introduction of the Hydra-Matic transmission as optional equipment on 1948 models. Special text books, manuals, and working models are being used to train dealers' staffs in servicing the transmission. It is now estimated that production of the Hydra-Matic units will be adequate to equip a large number of the 1948 Pontiac models, and the company is planning to provide each dealer with a Hydra-Matic equipped car at the beginning of the model run.

Motor Vehicle Factory Sales from U. S. Plants*

	Passenger Cars	Trucks	Buses	Total Motor Vehicles		
				1947	1946	1941
Total—Six Months.....	1,721,391	618,128	9,128	2,348,647	978,268	2,998,400
July.....	279,631	97,755	1,806	378,192	287,633	445,794
August.....	261,158	86,486	1,765	349,409	346,209	144,726
September.....	307,942	110,720	1,608	420,270	328,795	234,857
October.....	315,969	118,365	1,667	436,001	391,727	378,032
Total—Ten Months.....	2,886,091	1,031,454	15,974	3,933,519	2,342,632	4,201,799

FACTORY SALES TO DOMESTIC AND FOREIGN MARKETS*

	Passenger Cars		Trucks		Buses	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
Total—Six Months.....	1,589,563	131,828	485,616	132,512	7,950	1,178
July.....	257,881	21,750	78,444	19,311	1,694	112
August.....	240,358	20,800	68,382	20,104	1,570	195
September.....	285,590	22,352	89,724	20,998	1,413	195
October.....	295,099	20,870	94,307	24,058	1,527	140
Total—Ten Months.....	2,668,491	217,600	814,473	216,981	14,154	1,820

*Automobile Manufacturers Association.

NEWS of the AUTOMOTIVE INDUSTRIES

Harry G. Ferguson Heads Farm Implement Company

A reorganization of personnel of Harry Ferguson, Inc. following the resignation of Roger M. Kyes as director, president and general manager has resulted in the election of Harry G. Ferguson as president. Charles R. Vincent, Jr. also has resigned as director and assistant to the president. Mr. Ferguson has returned to America from Ireland to take personal direction of the company in its fight for an increased share of the farm equipment business. He did not divulge whether or not the company would attempt to manufacture a tractor in this country similar to the one now being built in England. The company gave up plans last spring to manufacture its own tractor at Cleveland.

Ford Buys Aircraft Plant From WAA at the Rouge

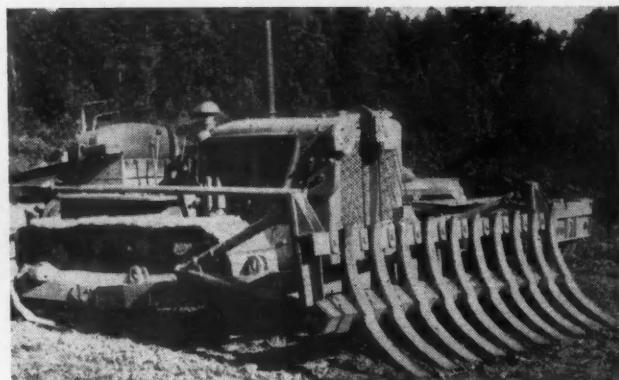
Speculation over the ultimate disposal of the aircraft building at the Ford Rouge plant has been settled by the announcement that Ford has bought the building together with six others from WAA. The aircraft building will be used for warehousing of parts and accessories, but under terms of the sale full use will not be granted for one year, during which time it must be maintained in its present condition. Certain parts including the test cells are not usable by Ford, and eventually may be torn down. A steel foundry on the property contains government-owned furnaces which are currently leased by Ford and will continue to be used.

K-F Plans Expansion To Cost \$3 Million

To be used in a \$3 million expansion and modernization program, 142,000 sq ft of floor space at the Continental Motors plant, Detroit, has been leased by Kaiser-Frazer Corp. The program will involve a new layout to improve working conditions and increase production.

Over 90% of '47 Oldsmobiles Equipped with Hydra-Matic

Indicative of the trend toward automatic transmissions for automobiles is the Oldsmobile announcement that over 90 per cent of 1947 Oldsmobiles produced thus far this year for domestic consumption have been equipped with GM's Hydra-Matic Drive. An extremely interesting



point is that this optional equipment was ordered specifically at extra cost by Oldsmobile buyers.

Texas Co. to Open New Jet Engine Fuel Laboratory

Next month the Texas Co. will open at Beacon, N. Y., the first privately financed industrial laboratory for the study of new fuels for jet-propulsion engines and rockets. Up to now, jet and rocket fuel research has been almost exclusively sponsored by the government for military purposes. However, Texas feels that jet engines and rockets will have important civilian applications, and that, therefore, special fuels will be an important segment of the business of engine fuel companies. The new laboratory includes a wind tunnel that will produce the effect of speeds up to 3.5 times the speed of sound.

Mack to Spend \$10 Million For Machinery and Buildings

In reporting net sales of \$90,623,414 and a net profit of \$5,265,883 for the first nine months of 1947, Mack Trucks, Inc., concurrently disclosed a planned expenditure of \$10 million in the next few years for new machinery, new tooling for model changes, and new buildings or renovation of existing buildings. Net sales for the first nine months of 1946 totaled \$29,599,019, resulting in a net loss of \$4,469,078, before effecting a provision for tax carry-back.

AMA Publishes Booklet On Motor Truck Influence

AMA has issued a new illustrated booklet "Horses to Horse Power" aimed at informing the public of the influence of motor trucks on daily living. Complementing a previous

Fleco Root Rake

To be marketed exclusively by the Caterpillar Tractor Co., Florida Land Clearing Equipment Co.'s Fleco Root Rake is made in sizes to match the Caterpillar Diesel D6, D7 and D8 track-type tractors. Caterpillar will also market the Fleco Detachable Stumper.

booklet called "Car Traveling People" which showed the effects of the automobile on changed habits and the standard of living in this country, "Horses to Horse Power" shows how the expanded use of trucks has enlarged the farmer's market, improved life in small towns, and served cities and suburbs.

Ford Asks Customers To Help Design New Models

By means of a four color questionnaire, the Ford customer is invited to design his own car by combining his choice of size, body style, engine, interior decoration, chrome trim, accessories, and such special equipment as overdrive and automatic transmission. Before starting he is requested to place at the top of a tally column the price he is willing to pay for a new automobile. The various illustrated components bear price tags, and after making his choice, he enters the price in the tally column. He then totals up the various items of the composite car of his choice and compares it with the price he is willing to pay.

Seiberling Opens Laboratory For Tire Sales and Service

Coordinating research for independent tire dealers and combining all dealer services under one roof, a sales and service laboratory was recently opened by Seiberling Rubber Co. in Akron, O. Opened in a building with 28,000 sq ft, the laboratory includes a model store, dealer schools, recapping and repair shops, and other dealer service departments.

British National Car To Race at Grand Prix

The combined efforts of all British automobile manufacturers and the direct cooperation of the British

NEWS of the AUTOMOTIVE INDUSTRIES

Government will be involved in the production of a super racing car which will represent Great Britain in the Grand Prix road races. To be known as the BRM, British Racing Motors, the car will be made under the direction of the British Motor Racing Research Trust, organized by important British motor trade firms, in a project headed by Raymond Mays.

Start Battery Production at Auto-Lite's Vincennes Plant

The Auto-Lite Battery Corp., a subsidiary of Electric Auto-Lite Co., shipped the first carload of batteries recently from its new \$2 million plant north of Vincennes, Ind. Equipment is still being installed, and the plant is not expected to get into full production before the spring of 1948.

New Bell Helicopter, 47D, Now in Quantity Production

A new general utility helicopter, Model 47D, is now being produced in quantity by Bell Aircraft Corp. Certificated by the CAA for agricultural and commercial operations, the new helicopter can be equipped for crop dusting, crop spraying, air mail and cargo pickup and delivery, and amphibious tasks.

Kaiser-Frazer To Offer Car With Leather Trim

Kaiser-Frazer will start this month to offer the Frazer Manhattan and Kaiser Custom with leather interior. The all-leather finishes will include upholstery, head lining and door pan-



Split Flaps

Preparing to roll over for a dive bombing run, the Navy's Martin AM-1 Mauler is shown poised with dive flaps split. A very heavily armed attack and dive bomber for carrier use, it was originally designated the XBTM-1.

els. Top grain leather will be used and a range of nine color selections will be offered.

Appoint C. E. Carll Head Of Ford Public Relations

Charles E. Carll, who has headed the Ford news bureau since 1944, has been appointed director of public relations for Ford Motor Co. by Henry Ford II, president. As head of the public relations department, Mr. Carll will have jurisdiction over the news bureau, community relations, graphic arts, and guest relations sections. John Rose, formerly assistant to Mr. Carll, has been named head of the news bureau.

Fairchild's NEPA Holds Heat Transfer Symposium

A heat transfer symposium was held Dec. 8-13 at Oak Ridge, Tenn., by the NEPA Div., Fairchild Engine and Airplane Corp. Several hundred persons, representing colleges, uni-

versities and member companies in the project, attended the symposium on heat transfer, which is of special importance in the application of nuclear energy for the propulsion of aircraft.

Pratt & Whitney Takes Over Magnetic Gage Co., Akron, O.

The manufacture of the products of the Magnetic Gage Co., Akron, O., has been taken over by Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford, Conn. Operations at the Akron plant will continue until early 1948, at which time they will be moved to West Hartford. Pratt & Whitney intends to make Magnetic Gage products as part of its own line.

New Goodyear Plant in Ala. To Make 30,000 Tubes Daily

Recently completed, Goodyear Tire & Rubber Co.'s new \$4 million tube manufacturing plant in Gadsden,

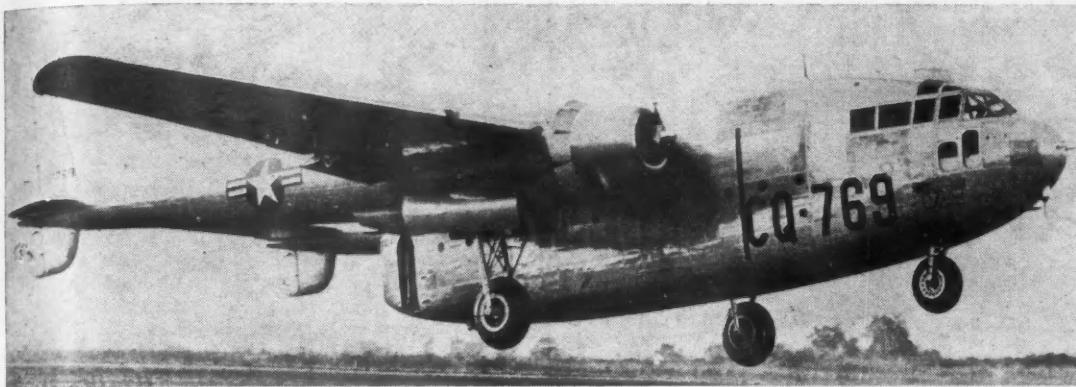
Shipments of Complete Aircraft and Aircraft Engines and Other Products of Their Plants, 1947*

AIRCRAFT		September	Nine Month's
Complete Aircraft		1,351	15,020
For U. S. Military:			
Number of Planes		323	1,323
Value of Planes and Parts		\$37,842,732	\$348,019,199
For Other Than U. S. Military:			
Number of Planes		1,026	13,697
Value of Planes		\$20,667,643	\$137,242,885
Value of Parts		\$2,387,353	\$15,760,209
Value of Complete Aircraft and Parts		\$60,877,728	\$501,022,293
Value of All Other Products Incl. Conversions		\$3,025,427	\$37,865,135
Total Value of All Products		\$63,903,155	\$538,887,428

* Bureau of the Census and Civil Aeronautics Administration.

AIRCRAFT ENGINES		September	Nine Month's
For U. S. Military:			
Number of Engines		426	3,544
Value of Engines		\$18,045,454	\$144,831,070
Value of Parts		\$4,685,666	\$30,045,593
For Other Than U. S. Military:			
Number of Engines		691	14,170
Value of Engines		\$2,112,257	\$40,818,390
Value of Parts		\$1,793,566	\$2,387,410
Total—Engines:			
Number		1,117	17,714
Value		\$20,157,711	\$185,649,460
Value of Parts		\$8,479,232	\$32,413,003
All Other Products, Value		\$110,413	\$3,434,852
Total Value, Engines and Parts		\$26,747,356	\$242,801,315

NEWS of the AUTOMOTIVE INDUSTRIES



International News

Airborne Box Car

The Fairchild C-119, an improved version of the C-82 Packet, is the U.S.A.F.'s newest cargo transport plane. Increased power, is the main improvement over the earlier model.

Ala., is reported to have a production capacity of 30,000 tubes a day.

Fairchild Gets \$22 Million Contract for C-119 Transport

Covering 37 units of the C-119, an advanced type of U.S.A.F. transport plane, Fairchild Engine & Airplane Corp. has been recently awarded a \$22 million contract. Fairchild now has a backlog close to \$47 million. Two Pratt & Whitney Wasp Major engines, developing 3500 hp each, power the C-119 which can fly nine tons of payload for 2000 miles.

Labor

K-F Rewards Presenteeism By Distributing \$650,889

Presenteeism, as distinguished from abstenteeism, will be rewarded shortly at Kaiser-Frazer to the tune of \$650,889. This amount represents K-F's Security Trust Fund, which is based on the accumulation of \$5 for each Kaiser or Frazer car shipped from Willow Run and \$1 for each Rototiller farm machine, to be distributed to workers who meet requirements for presenteeism, length of employment and non-participation in any work stoppage. The fund, representing part of the corporation's labor agreement with the UAW-CIO, will be distributed in time for Christmas shopping.

New GM Group Insurance Furthers Employe Security

Representing one of the most advanced moves in the field of employe security, GM will offer a new and substantially improved group insur-

ance plan to its employees in January. Applying to both salaried and hourly employes, it is expected that the new plan, which affords better protection against total loss of income because of death, illness, or injury, will become effective Feb. 1, 1948. Eligible employes retain a portion of their insurance after age 65, and no contributions will be required for this continuing insurance under the new plan. An employe who may have to leave GM after age 60 and who meets service requirements is permitted to continue part of his life insurance until death. In addition, the life insurance protection and the sickness and accident coverage which employes now have, are substantially improved. Additional benefits are payable for death from accidental cause, and for certain severe non-fatal accidents, on or off the job. This extra payment may amount to as much as 50 per cent of the employe's life insurance, with a top limit of \$4000. A monthly income is provided for a specified period for longer service employes who are totally and permanently disabled before age 60.

UAW Executive Board Purges Its Opponents

The UAW-CIO executive board, now under the complete domination of the Reuther faction, is completing a purge of dissident factions, including Communist elements. Among those to feel the axe are Richard T. Leonard, former national Ford director and vice president of the union; James Wishart, director of facts and statistics; Maurice Sugar, general counsel for the union for the past ten years; as well as a large number of organizers. Nathan Weinberg, former government economist and statistician, has been named as the new director of research. The board also

fired all officers of the Allis-Chalmers local at Milwaukee which was embroiled in an 11 months strike resulting in the loss of bargaining rights. The local allegedly has been Communist dominated. An administrator has been appointed to reorganize the Allis-Chalmers plant and to set up a six point program to regain bargaining rights.

Metals

Copper

A continuing strong demand is reported by producers, and it is anticipated that books for January sales will be opened shortly. At quoted levels, the price is firm. A strong wire mill demand, and an improving brass mill demand, volumewise, are both noted currently.

Lead

Two indications of a possibly critical lead market are urgent requests by consumers and reported declining shipments from Canada in recent months. January books are expected to be opened at any time.

Tin

A responsible source indicates that no discussions are underway between RFC officials and Bolivian mine owners to fix the price the U. S. will pay during 1948 for Bolivian concentrates, although logically it would seem to be time of year when such negotiations should be taking place. A price of \$1.00 per lb of tin contained in concentrates, as contrasted with the present basic price of 76¢ has been mentioned as possible, but this is pure conjecture.

(Turn to page 90, please)

Fig. 1 (Below)—Diagrammatic sketch of the design of an air engine. V_w is the hot chamber, V_k the cold chamber, with the corresponding pistons Z_w and Z_k . B is the burner, H the heater, R regenerator, K cooler, S crankshaft, D connecting rods and C_1 , C_2 fixed pivots.

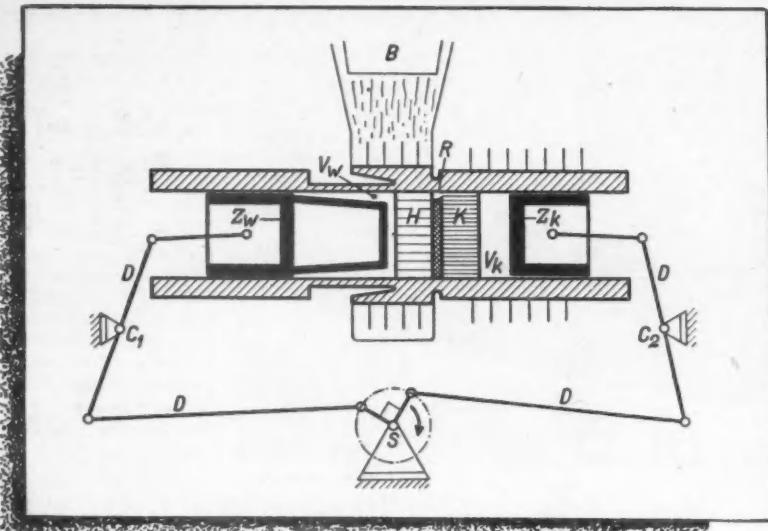
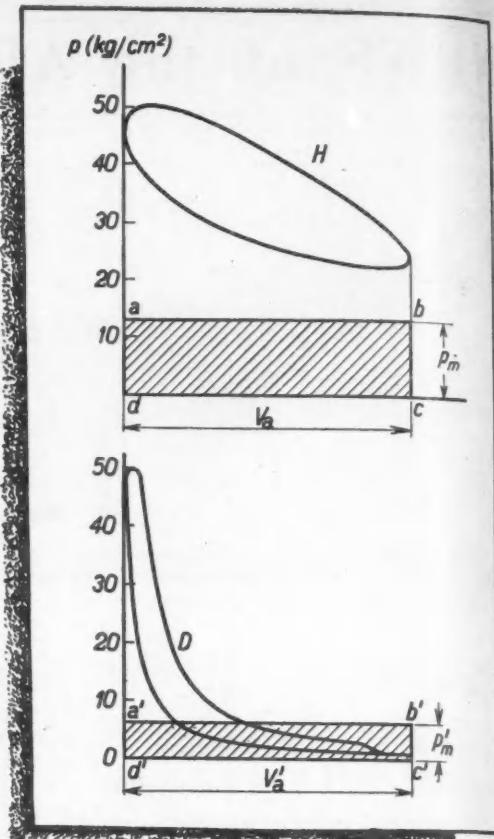


Fig. 2 (Right)—Comparison of the indicator diagrams of an air engine **H** and a two-stroke Diesel engine **D**.

For both, the maximum pressure has been chosen equal to 50 atm, while the swept volume V_s is also assumed to be equal in both cases. In the figure the mean effective pressures P_m are also indicated: P_m is the height of the rectangle abcd whose base is equal to V_s and whose area corresponds to that of the curve **H**. In the same way P'_m is the height of the rectangle $a'b'c'd'$ whose area is equal to that of curve **D**.



Philips Air Engine

THE principle of obtaining work from the expansion and compression of air dates back to 1816 when a Scottish clergyman named Stirling built a two-piston air engine weighing several hundred pounds and developing only a few horsepower. In 1850 Ericson built a marine air engine for the U. S. Navy, which used four 14-ft diam pistons and operated at about 10 rpm to develop 300 hp.

However, the classical air engine could not compete with the steam engine of its time and, later on, with gasoline and Diesel power plants. Subsequently, little progress was made with the air engine until several years ago when scientists at the Philips Research Laboratory, Eindhoven, Holland, revived its development and last year announced that it had been found possible to

build a high speed air engine to operate at an efficiency comparable with that of the internal combustion engine by making use of modern materials and modern conceptions of heat transfer and flow resistance.

An idea of the tremendous advancements achieved by Philips can be obtained from the fact that in 1923 a 1500-lb air engine with a piston displacement of 1525 cu in. developed two hp, while the same power can now be had with an engine 50 times lighter in weight and with a displacement 125 times smaller. This Philips air engine, to be manufactured in various sizes by the newly-organized company of Thermomotor Co. at Eindhoven, was described in a recent series of articles in the Philips Technical Review, which are the basis of this article.

THE air engine in its new form, as designed in the research laboratories of N. V. Philips' Gloeilampenfabrieken, Eindhoven, Holland, possesses many favorable properties which until now had been considered only possible in internal combustion engines. It has proved possible to build compact, light, high-speed air engines of high power with an efficiency

comparable to that of internal combustion engines. At the same time, however, all the fundamental advantages of the air engine over the internal combustion engine or other prime movers have been retained in the new form. Other advantages include the possibility of using all kinds of fuel, low wear since the surfaces of the cylinders do not come into contact with

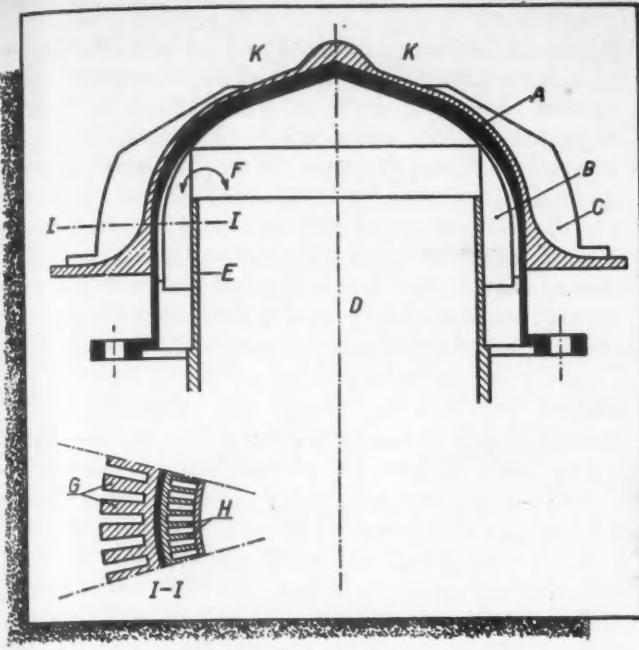


Fig. 3—Cross section of the heater of a Philips air engine showing vertical cross section (upper) and part of horizontal cross section at I-I (lower).

A bonnet of heat-resisting steel is shown at A. At B are fins of aluminum bronze for the heat exchange with the work medium (see also at H in the horizontal cross section); at C are fins of aluminum bronze for the heat exchange with the flame of the burner (see G in horizontal cross section); D is hot space; E is wall of the hot space. The fuel is burned at K, with the flame led through the slits between the fins G. Fins G and H, the latter as a result of the good heat conduction, are thus heated to the required temperature. The heat exchange with the work medium takes place in the slits between the fins H. The work medium can enter or leave the hot space only via the paths indicated by the arrow F (the hot space is closed at the lower side by a piston not shown here).

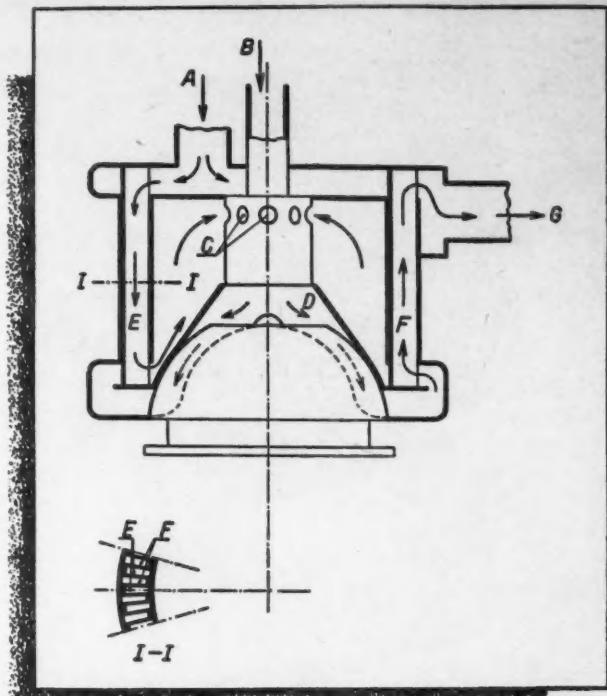


Fig. 4—Cross section through the preheater of a Philips air engine, showing vertical cross section (upper), and part of horizontal cross section at height I-I (lower).
The air for combustion enters at A, following the path of the arrows, and passes through the channels E and enters the space D via the openings C. The fuel gas, which enters through B, is mixed with the air in D where the combustion takes place. The heater (Fig. 3) along which the flame is led is indicated by dotted lines. The products of combustion are passed off via the channels F and the opening G. The side-by-side arrangement of the annular channels E and F, shown in the horizontal cross section, insures a good heat exchange between the air entering and the combustion products escaping.

By H. de Brey and F. L. van Weenen

N. V. Philips' Gloeilampenfabrieken Eindhoven, Holland

any corrosive gases, low consumption of lubricating oil, little noise since there are no valves and no periodic explosions, and uniform torque.

Principle of the Air Engine

A certain quantity of air, or some other working medium such as hydrogen, helium or argon, which is at a high temperature, is allowed to expand in a cylinder, the hot space, where it performs mechanical work by the movement of a piston. In another cylinder, the cold space, the expanded air is cooled and compressed by the action of a piston to the original volume. It is then heated to the original high temperature, and the cycle begins anew. The compression of the air requires mechanical work; however, since this compression takes place at low temperature and thus at low pressure, the work required is less than that which the air performs upon expansion at high temperature and high pressure. The engine thus produces an excess of work.

A possible model of an air engine, very much simplified, is shown in Fig. 1. It may be seen that the movement of the air to and fro from the hot to the cold space and vice versa is accomplished by two pistons

moving approximately sinusoidally, whose motions are about 90 deg out of phase. Since the four different stages of the process: expansion, cooling, compression and heating cannot be entirely separated, they partially overlap. In spite of this the machine functions as an engine provided that the volume changes of the hot space are advanced in phase with respect to those in the cold space. Upon the phase angle depends the power and, to a lesser extent, the efficiency. Both exhibit an only slightly pronounced maximum at a phase difference of about 90 deg; while if the phase angle is chosen negative, the engine then consumes energy and acts as a refrigerator.

In Fig. 1 the regenerator is shown between the parts where the air is heated and where it is cooled. Its function is to store the heat which the air gives off after the expansion when passing to the cold space. When after compression the air is returned to the hot space, it again passes through the regenerator and takes up the heat stored there.

The use of modern materials has made it possible to increase the maximum pressure in the air engines developed by Philips to approximately the same level as in internal combustion engines, about 50 atm. The

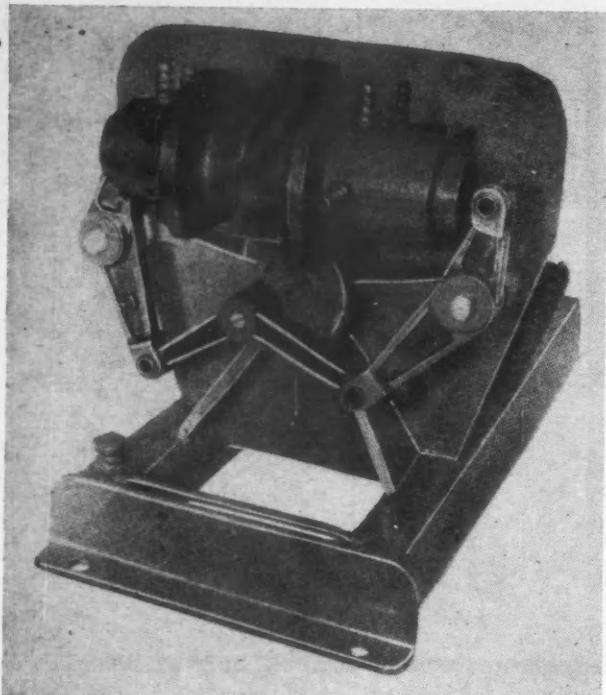


Fig. 5—Experimental model of an air engine constructed according to the principles of Fig. 1. The position of the parts is the same as in Fig. 1.

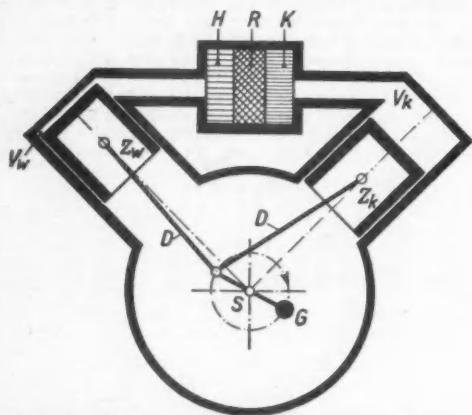


Fig. 6—Diagram of an air engine of V- construction. The letters have the same meaning as in Fig. 1, while G is the counter-weight.

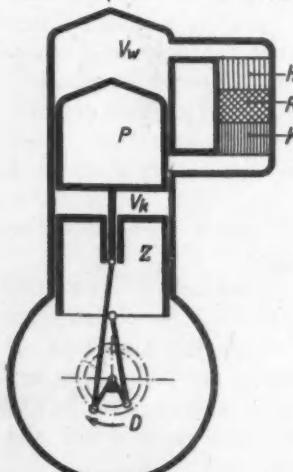
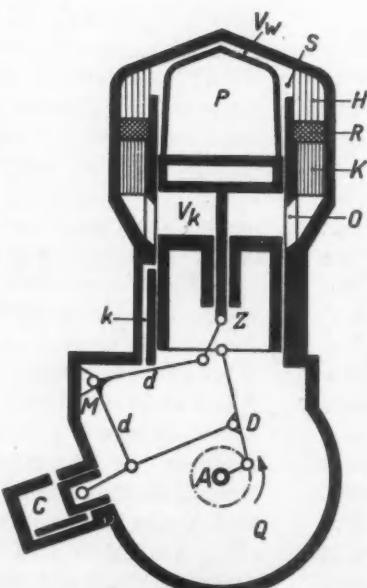


Fig. 7—Diagram of an air engine with transfer piston where only one cylinder is used. For the meaning of the letters see Fig. 1.



minimum pressure is then about 22 atm, the expansion ratio 2.3, and the mean effective pressure about 14 atm. This is more than twice as high as in ordinary internal combustion engines in which, as a result of the less favorable shape of the indicator diagram, a mep of about six atm is obtained. These conditions are shown diagrammatically in Fig. 2. In the case of internal combustion engines somewhat higher values of mep can also be reached, but this requires very complicated auxiliaries such as a compressor with high air yield, possibly combined with an exhaust-gas turbine.

Output

Engine speed is limited mainly by two factors. First, piston speed and thus the inertia forces of the moving parts increase with the engine speed. Secondly, with a higher speed the work medium must flow to and fro between the hot and cold spaces more quickly, thereby not only increasing the losses due to flow resistance in the heater, the regenerator and the cooler, but making it more difficult to obtain the required heat transfer in these three elements. Because of new construction of the three elements, the problems of flow resistance and heat transfer no longer constitute an obstacle in increasing the speed engine. Also, piston speeds become smaller the higher the pressure of the air engine is raised, and a given power can be obtained with a smaller swept volume. As a result it is possible to raise the speed to 3000 rpm or higher, which leads to a considerable increase in the specific power.

The magnitude of the improvement achieved in this way is made clear from a comparison with the old two-hp air engine which had a swept volume of 15.25 cu in. The same power is now attainable with an engine of only about 12.2 cu in. constructed for the same long life. The swept volume has thus been reduced to 1/125. The weight of the engine has also been very much reduced; in the case of a two-hp engine a reduction by a factor of 50 has been attained.

In the Philips air engine high efficiency is obtained by a very compact construction. For the latest model of the largest engines (several hundred hp) the mechanical efficiency amounts to more than 90 per cent.

Heater

In order to obtain a satisfactory heat transfer, a special heater was introduced. This heater raises the air at

Fig. 8—Cross section of the single-cycle Philips air engine.

The hot and cold spaces, respectively V_w and V_k , are in one cylinder and separated by transfer piston P with an insulating cap. The heater H , regenerator R and cooler K are annular in shape and built around the cylinder. S is the outlet of heater into V_w ; at O are ports between cooler and V_k . The connecting rod D of the piston Z and the driving mechanism d of the transfer piston are housed in a closed crankcase Q in which air is maintained at the minimum pressure of the cycle in the cylinder. The drive d with fixed pivot M is such that only extremely small lateral forces act on the transfer piston. Air which has leaked into the crankcase is returned to the cylinder via the channel C . A is the pressure pump; B is the engine shaft.

the entrance to the hot space to the desired temperature, about 650 C. The construction of the heater is simple in principle: a channel with a large internal wall surface obtained by the introduction of a large number of internal fins of sufficient length. The air is forced to flow through the narrow slits between the fins. The construction of this heater is shown in Fig. 3, where the large number of channels formed by the internal fins can be seen. The outside of the heater is kept at the desired temperature by a burner. In order to insure the best possible heat exchange the outside also is provided with fins which are in direct contact with the flame of the burner. The internal and external fins are constructed of a good heat-conducting material, such as aluminum bronze which makes the temperature gradient in the fins small. The wall to which the fins are attached must be made of heat and creep-resisting steel in order to withstand the high pressure. Since, however, this wall is thin, the slight heat conductivity of this steel has little effect.

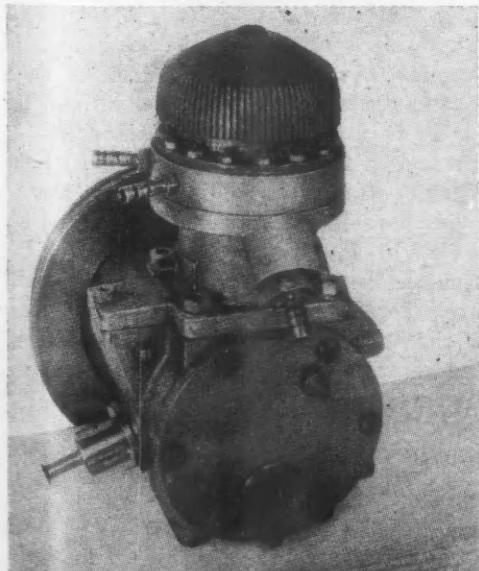
Cooler

Constructional requirements of the cold space walls can more easily be met because of the lower temperature. As far as the heat transfer is concerned, however, this situation is analogous to that of the hot space. In order to reach and maintain as low a temperature as possible in the cold space, the cooler is introduced at the entrance to the cold space. Its construction shows great similarity to that of the heater. Internally it corresponds exactly to the heater. The outside of the cooler is cooled with water or with air.

Regenerator

The satisfactory results obtainable with this heater construction and cooler in practice are due to the re-

Fig. 9—Photograph of an experimental model of the single-cycle Philips air engine. At the top is the heat exchanger of the burner, built around the heater. At the bottom on the left is the pump with screw for regulating the pressure. Behind the engine is the flywheel.



generator which lightens the task of the other two elements. Without the regenerator the heater would have to heat the air from, for instance, 100 to 650 C each time, whereas with the regenerator the air has only to be heated from about 500 to 650 C. In the same way, without the regenerator the cooler would have to cool the expanded air each time from about 500 C to, for instance, 60 C; whereas with this device it is only necessary to cool from about 120 C to 60 C.

The regenerator has to store the heat liberated as the air or work medium passes from the hot to the cold space, and it has to give up this heat again when the movement is reversed. Without a regenerator the heater would have to supply about four times as much heat. The efficiency of the engine could not then be more than $\frac{1}{4}$ of what can be obtained when an ideal regenerator is present.

In order to approximate an ideal regenerator as nearly as possible, care must be taken that the heat exchange with the air takes place quickly enough. For this purpose the flow channels in the regenerator must have the correct dimensions, the compromise between heat transfer, flow resistance and dead volume being taken into account. Also, a large heat capacity of the regenerator is required. With an ideal regenerator the process of storing up and giving off heat is reversible in every phase. In order to approximate this it is necessary that, when flowing through the regenerator, the air should only differ slightly in temperature from the surroundings. The temperature distribution prevailing in the regenerator must form a certain gradual transition from the heater to the cooler. In order to maintain this temperature distribution and to obtain only slight temperature fluctuations during each revolution of the engine, the heat capacity of the regenerator must be large compared with the heat capacity of the air flowing periodically back and forth through the regenerator. The heat conductivity of the regenerator in the direction of flow must be slight, otherwise a continual flow of heat occurs from the heater to the cooler, which means a loss.

It has been found possible to construct a regenerator through the use of a porous coil of thin metal wire, which comes very close to the ideal, with efficiencies of 95 per cent and more. It is remarkable that such a coil of metal wire is able to raise the temperature of the quantity of air flowing through it from about 100 C to about 600 C within 1/1000 sec or

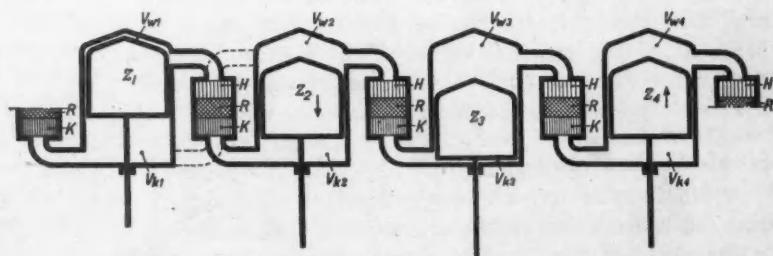


Fig. 10—Principle of the Philips multi-cylinder air engine.
In each of the four cylinders is a hot space at the top, V_{w1} to V_{w4} , and a cold space at the bottom V_{k1} to V_{k4} . The hot space of each cylinder is connected via a heater H , regenerator R and cooler K with the cold space of the next cylinder. The pistons Z_1 - Z_4 of the successive cylinders move with a phase difference of 90 deg.

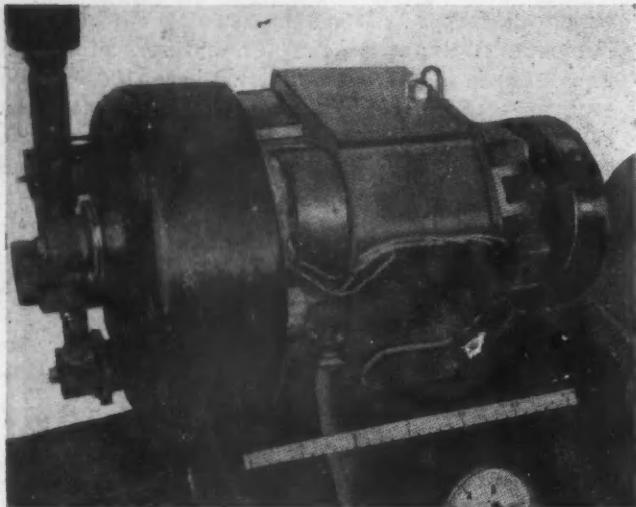


Fig. 11—Practical model of the Philips multi-cylinder air engine. This is a four-cylinder engine with parallel cylinders placed in a square with a wobble-plate mechanism for the transmission of the motion of the four pistons to the engine shaft. The engine can deliver 15 hp at 3000 rpm. The model shown is run with gas as fuel. In the photo, the hot side of the engine is on the left and the cold side on the right. The pipe for the fuel supply is on the extreme left, and the cap on the left contains the heater. Part of the jacket of three cylinders is visible. On the extreme right are the wobble-plate mechanism and the flywheel. With this mechanism the engine shaft is parallel to the axes of the cylinders. The driving mechanism is in a closed crankcase, the cover of which has been removed here for clearness. The wires connected to the terminal board in the middle are connections to a number of thermo-elements introduced at various points in the engine for taking test measurements.

the reverse, and that temperature gradients of several hundred degrees per centimeter in the direction of flow can exist in it without appreciable loss of heat.

The Preheater

The heater has a temperature of more than 650 C. The flame and thus the products of combustion—the exhaust gases—necessarily have a still higher temperature. If the exhaust gases are allowed to escape unused a considerable amount of heat is lost. This loss can be very much restricted by the use of a heat exchanger in which the exhaust gases give off their heat in counterflow to the air entering for the combustion. Such a preheater has been developed. It has the form of a pleated collar of heat-resisting sheet material, the exhaust gases being passed along one side of the pleats while combustion air flows along the other side. By this means a very intense heat exchange is obtained, and the exhaust losses can be restricted to about 30 per cent of the original value. Fig. 4 shows a preheater for gaseous fuel constructed in this way and adapted especially to the design of the air engine.

Single-Cycle Model

A single-cycle experimental model of the air engine, built according to the scheme of Fig. 1, is shown in the photo of Fig. 5. The drawbacks depriving this design of any great practical importance are of a mechanical nature, since the transmission is rather complicated. The housing of the driving mechanism in a crankcase, as is customary in internal combustion

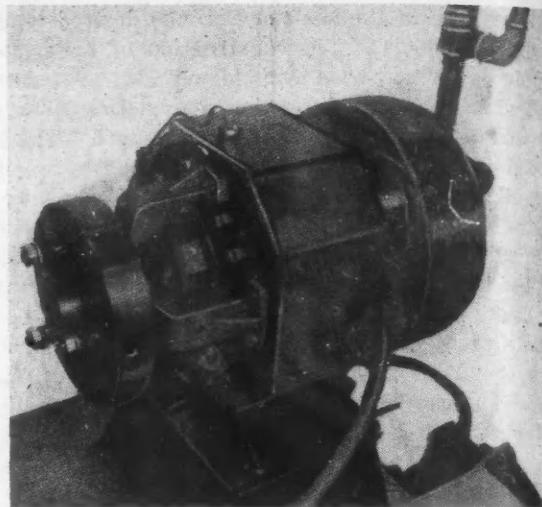


Fig. 12—This photo shows the engine of Fig. 11 as seen from the other side. It gives a better view of the wobble-plate mechanism between the flywheel and the engine block. Note the compact construction obtained with the mechanism.

engines for many obvious reasons (i.e., for good lubrication) involves elaborate and expensive constructions.

Furthermore, with the construction of the two pistons moving along the same line, but with a certain phase difference, the engine cannot be balanced in a simple way—an objection which arises in the case of every normal single-cylinder engine and which weighs all the more in the designing of an engine with a high speed and or a high power. Finally, it is a great disadvantage for the mechanical efficiency that this construction works with two loaded pistons with different pressures on either side of each piston. In order to minimize leakage along the pistons, they have to fit tightly and this results in frictional losses.

The V-construction

A number of the mechanical drawbacks involved in the single-cycle engine can be avoided by modifying the design to that of Fig. 6. The two halves of the cylinder in Fig. 1 containing the hot and cold spaces have been turned into separate cylinders with their axes placed at an angle of 90 deg to each other. In this V-construction the driving mechanism is much simpler since a closed crankcase is possible, and the engine can easily be almost completely balanced.

The disadvantage of the two loaded pistons with the single-cycle design also exists in the case of the V-construction, but here it does not count so much because, in the case of an elevated pressure where the frictional losses occur most, the crankcase can be put under pressure, thereby considerably reducing those losses. Thus, the V-construction is very suitable for high-speed engines of low power (for instance less than one hp) where the efficiency is not decisive.

Construction with Transfer Piston

The old air engines nearly always had only one loaded piston. This was made possible by the use of a
(Turn to page 58, please)

As Romney Sees Europe

An Interview with George Romney, Managing Director of the AMA

by Leonard Westrate

ASIDE from the problem of hunger, which probably is transient unless the calamity of climate strikes again next year, the major trouble in Europe today lies much deeper than dollars or technical assistance. The basic trouble is that industrial economy in Europe is built on economic ideas of the past. Its leaders have no concept of competition as it is known in this country. All they know is the anemic and watered-down version that exists within the framework of industrial cartels. They are convinced that competition is wasteful because industry would have more capacity than demand. Consequently, there is no incentive to improve products or processes and to get a larger percentage of the business. Thus, costs remain high and so do prices. European countries cannot compete in world markets against other countries where compulsion of competition drives industry to vigorous and efficient methods that will lower costs and prices and eliminate waste.

At the Metal Trades Industries Conference of the International Labor Organizations in Stockholm, Sweden, this Fall, a European industry representative proposed in all seriousness that, to fight Communism, the United States should be a party to a tripartite committee that would limit production of metal goods and allocate the distribution in European markets. He then capped this fantastic proposal with the observation that Europe could not compete with U. S. manufacturers on an equal basis if such a scheme were not adopted.

To appreciate the effect of the traditional European viewpoint toward competition on a nation's economic health, it is only necessary to look back to the years following World War I. Then, as now, Europe was in bad shape economically, and the United States made reconstruction loans amounting to about \$6 billion. The reason those loans went sour is that we did not insist that industry there get on a sound competitive basis. With their cartels which limited production and fixed prices, they could not meet the competition of goods produced at lower costs in this and other countries. This time we should attach conditions to any loans to require recipients to follow the proved technique of unrestricted competition which will lower costs and prices and enable them to compete in the world market. That is the only way we can get our investment back.

If the United States is to bail Europe out of its present predicament, we must not deal on a government-to-government basis. That would not permit the United States to insist on European industry follow-

WHILE abroad as an employer delegate to the recent Metal Trades Industries Conference of the International Labor Organization at Stockholm, Mr. Romney spent two months in Great Britain, Netherlands, Denmark, Sweden, Germany, Switzerland, France and Northern Italy studying the European economy. Most of his contacts were with business men in addition to government, labor and employer delegates at the conference. What he found in Western Europe and how he believes the United States should help to solve its economic ills are summarized in this informative article.

ing sound business principles. It would only lay the United States open to charges of interfering with the European governments if attempted. Also, loans directly to foreign governments, many of them semi-totalitarian in nature, would be handed directly to cartelized industries. We should make the loans available from industry and banking groups in this country to private agencies in European countries. That way, we could investigate the borrowing industry as to policy, cartel tieups, management, capital equipment, processes, and distribution. By dealing on a purely business basis, it would be possible to attach conditions requiring free competition. Exceptions would have to be made, of course, in the case of industries which already are nationalized. And the United States government should participate only to the extent of guaranteeing the private loans up to 85 or 90 per cent of their value.

The dilemma in England today is that, under neither the Socialistic nor Conservative governments, can free competition work. Under the present form of government in England, the trend is toward nationalization of industry with tight government control over production and prices. A return of the Conservative Party to power would only mean a return to private totalitarianism through agreements on production and prices. The loss of British foreign investments has served only to reveal the basic trouble—that England has lost its ability to produce cheaply enough to be the formidable competitor it once was in world markets. Until all the countries of Europe learn once again to appreciate the principle of free and unrestricted competition, there is little hope of a strong economic revival. In any event, it will be a long time before Europe will be the factor in world trade that it was

(Turn to page 86, please)

Huge Presses at Work

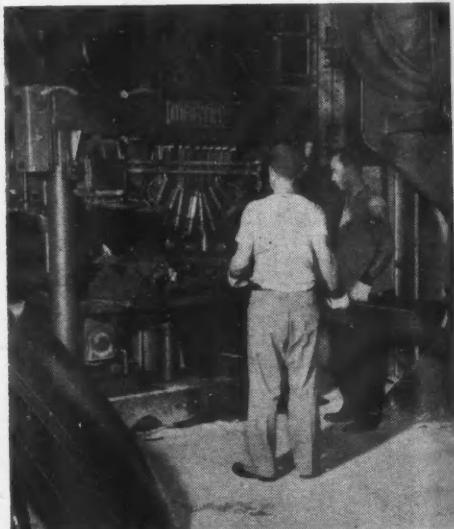


Drawing and trimming of K-F deck lid inner panels is done in this 750-ton Baldwin-Southwark triple-action hydraulic press, tended by a crew of four men, two on each side. Both the draw and trim dies are set up in the same press. The view shown here is the back of the press where the finished stamping is discharged onto a gravity conveyor.

IN ITS scheme of sub-contracting, the Kaiser-Frazer Corp. draws upon the facilities of Kaiser Fleetwings, Bristol, Pa.—the appliance division of the Kaiser industries—for its supply of deck lids for passenger cars. These deck lids are composed of an inner and outer panel made of 0.035 in. steel sheet, deep drawing quality stock being used only for inner panels. Outer panels require finer surface finish but do not need the same deep drawing quality. Upon receipt of sheet steel at Bristol a sample of each heat is tested in the metallurgical laboratory for grain size, surface condition, and general drawing properties to determine the methods in future handling and for roller leveling. The sheet then is sheared to the proper size for inner and outer panels. Major presses operations at the Fleetwings plants are shown on this page.



A group of three Bliss presses is conveniently arranged to punch holes for hinge and drain, lock catch, and lock assembly in the inner panel. The panels are fed, by the gravity conveyor from the 750-ton first operation press, to the first machine in the line.



Final assembly of the deck lid. Hemming of inner and outer panels into an integral unit is done in the press at the right, while the 40 spot welds are made in the multiple-spot Martin welding machine at the left.



(Left) Drawing of outer panels is handled in this Baldwin-Southwark triple-action hydraulic press of 2500-ton capacity.

for Kaiser-Frazer

THE press shop at Willow Run has been progressively increased in scope and number of pieces of equipment since the beginning of the program, now boasts a considerable installation of enormous presses supplied by Clearing and Hamilton, some being of double-action and triple-action type. The group of illustrations shown on this page is a sampling of major press operations in making steel roofs and hoods. The roof sections are produced in the large Hamilton presses, while hoods are made primarily in Clearing presses.

Photos on this page by Ewing Galloway, N. Y.



The Kaiser-Frazer roof panel, said to be the largest in the industry, is made in four separate press operations. First step is drawing in this 1200-ton double-action Hamilton press.



This is third Clearing press in the line-up for producing hoods. Of 900-ton capacity, it has three stations and completes the 4th, 5th, and 6th detail forming operations.

(Right) Six press operations are required to produce the Kaiser-Frazer hood, all tooled on this row of three Clearing presses. The first drawing operation, using the blanks which may be seen at the right, is done in a 1500-ton triple-action Clearing. The other two presses are of 900-ton capacity.



The next two operations on the roof panel—trimming of the front and rear ends is done in this 1000-ton Hamilton press. As shown, the press is fitted with two separate die sections—the one at the left trimming the rear end, while the one at the right trims the front end.



Hudson Commodore
Eight four-door sedan



Entirely Different Hudsons for '48

*New 121 Hp Six-Cylinder Engine, Monobilt Body and
Frame Construction, Hypoid Rear Axle, Lower Center of
Gravity, Full Width Bodies, and Advanced Styling*

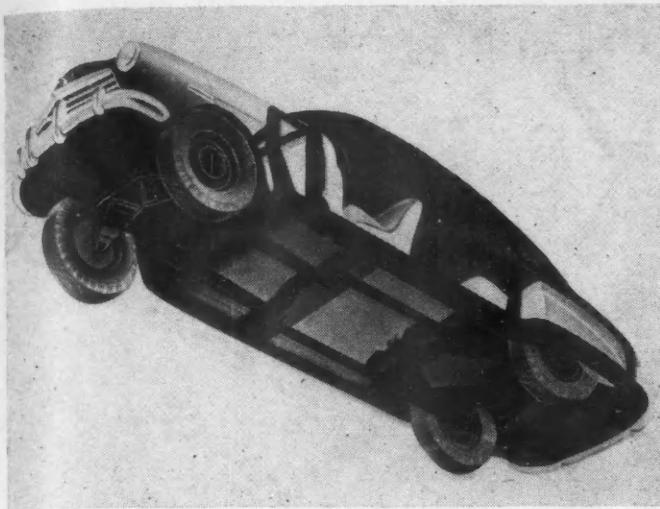
Condensed Hudson 1948 Engine Specifications

Type	Super-Six	Super-Eight
No. Cyl.	L-head	L-head
Bore (in.)	6	8
Stroke (in.)	3 9/16	3
Displacement	4 1/2	4 1/2
Max. bhp (bare engine)	262 cu in.	254 cu in.
Compression Ratio	121 at 4000 rpm	128 at 4200 rpm
Std.	6.5 to 1	6.5 to 1
Optional (with aluminum head)	7 to 1	7 to 1
Number main bearings	4	5
Piston	A No. 132 Lo-Ex aluminum alloy with T-slot, cam-ground	

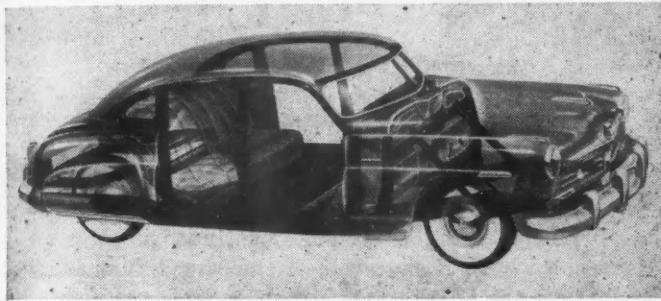
By Joseph Geschelin

Two lines—the Super Series and the Commodore Series—both with a wheelbase of 124 in., are offered in the new Hudson, accenting sparkling styling of advanced character. Styling treatment stems from what is termed "Monobilt" body structure in which the body and chassis frame are combined in a unit, resulting in an overall height of only five feet from the ground line to the roof with a consequent lowering of center of gravity.

Despite the low roof level the interior is said to give ample headroom through dropping the underbody to the level of the lower edge of the integral side rails.



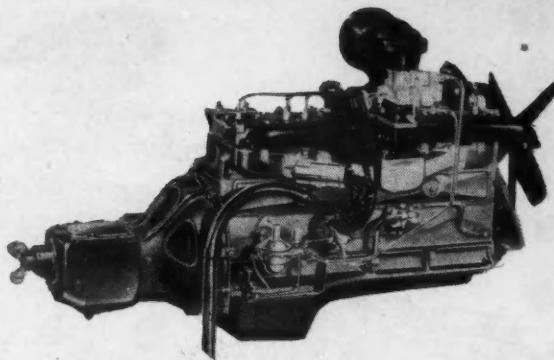
Underside view showing how the outer longitudinal side members extend outside of the rear wheels. Vertical members extend upward from the outside rails to the roof



Phantom view illustrating the frame and body construction which enables Hudson to lower the floor and seats

At the same time the center of weight has been shifted forward by moving the engine cradle over the front suspension and moving the rear seat completely ahead of the rear wheel housings. It is said that this arrangement results in a better ride for the passengers and improved roadability. The front seat now is 64 in. in width while the rear seat is 63 in. wide. To assure full use of the wider seats, the door trim panels are recessed to give ample elbow room.

Before coming to specific details of features, it is of interest to mention briefly some of the major features offered in the new Hudsons. First is the modernly styled "Monobilt" body. Next is the completely new six-cylinder engine, featuring full pressure lubrication and displacement which makes it the largest six-cylinder passenger car engine listed today. The new line also marks the first use of hypoid rear axles in Hudson cars. From a service standpoint a noteworthy feature is the improvement in the Drive-master equipment with unit mounting of all controls accessibly on the engine. Of newsworthy interest is the adoption of the so-called super cushion, low pressure large cross-section 7.10-15 Goodyear tires as standard equipment on both models; 7.60-15 tires are



Hudson Super Eight 128 hp power plant

available as an option on both models.

The Super-Six engine, rated 121 hp, which makes it the most powerful six on the market, was designed to give exceptional performance comparable to the eight, particularly with respect to low speed torque. It has full pressure lubrication, with rifle drilled connecting rods and pressure lubrication to valve tappets. To achieve compactness of the combustion chamber, valves are inclined towards the cylinder axis. Longer valve life and improved cooling are afforded by water-jacketing designed to direct cooling water to the hottest areas of the valve seats, particularly around exhaust valves, and the full length of cylinders and combustion chambers.

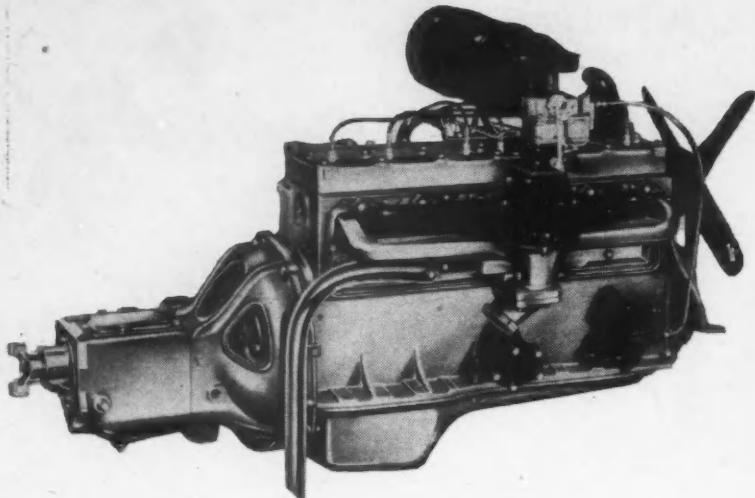
Positive rotation of the improved mushroom type tappets is said to be assured by the use of an angular cam surface. The camshaft is driven by a non-adjustable silent Morse chain, with pressure jet lubrication at the point where the chain meshes with the drive sprocket.

The four-bearing, drop-forged crankshaft is fitted with precision type steel shell bearings with babbitt lining, all rod bearing shell halves being interchangeable. The same type of bearing is used for the cam-shaft.

Hudson continues the use of a dual downdraft carburetor with a single float, each barrel feeding three cylinders to afford better mixture distribution with improved economy and performance. Better vaporization is provided by a thermostatically-controlled carburetor heater which utilizes exhaust gases to heat the intake manifold. The new water pump is of self-sealing and self-lubricating type with the shaft mounted on a double row ball bearing. The cooling fan has four blades of assymetric spacing to reduce noise.

The lubricating system is protected by the well known Floto-type screen at the suction end of the oil pump, the latter being of rotor type.

Another feature of the lubrication system is the provision of a pressure control valve to the pad for the optional oil filter mounting. It is so arranged as to prevent flow to the filter until operating pressure has



New Super-Six 121 hp engine and transmission

been established, thus it prevents drainage of the filter while standing.

Both the Super-Six and Super-Eight engines have a standard compression ratio of 6.5 to 1 and an optional ratio of 7 to 1, the latter requiring an aluminum cylinder head. The standard cylinder head gasket is made of steel sheet with copper ferrules at the openings; with the aluminum head, the same type of gasket is used except that the ferrules are of cadmium-plated steel to prevent galvanic action. Both engines have pistons of aluminum alloy of T-slot type, cam-ground, with two oil and two compression rings, pinned, and tin-plated. Three rings are above the piston pin, one in the skirt.

The ignition coil is located on the engine, closer to the distributor to reduce interference with television and radio receivers, and permitting better waterproofing. On the Super-Six, the exhaust pipe is attached to a center connection in the exhaust manifold, the latter having individual porting.

A new type cellular tubular radiator is used with both engines. Powerplants are three-point mounted on newly-designed rubber motor mounts. Improved accelerator linkage is said to give practically effortless throttle operation while transmission of road vibration to the gear shift lever is prevented by the use of a ball crank control mounted on the frame.

A new anchor-plate type starter with longer shaft assures positive engagement and greater life. It is operated by a push-button on the instrument panel.

Because of the forward location of the powerplant, the propeller shaft drive is in two sections, with two accurately balanced propeller shafts and three universal joints in the train, the latter having needle bearings and provided with lubrication fittings. The midship propeller line sealed ball bearing is mounted on a cross-member at the rear end of the front shaft and is insulated from the frame by a large rubber mounting.

Hypoid rear axles have a standard ratio of 4.1 to 1; and an optional ratio of 4 5/9 to 1. The well-known Hudson, balanced, single-wet-plate clutch with cork inserts is continued.



Recessed door panels provide an extra two in. of elbow room for passengers

The Super-Eight engine is continued unchanged in specifications. Longer life of the camshaft is attained through the application of a phosphate treatment.

Of interest from the maintenance standpoint is the provision for removing the engine oil pan to facilitate replacement of rings and pistons and bearings without removing the engine from its mounting. This is a specific problem with unitized body construction. To this end Hudson has arranged the front suspension cross-member for easy dis-assembly in the event of an engine overhaul. To effect this operation, the front end of the car is lifted and the cross-member fastenings loosened and later removed. Then two long bolts—part of the tool equipment for this job—are inserted and fastened at the ends so as to permit the suspension to be dropped about four inches, this being sufficient to permit removal of the pan without difficulty.

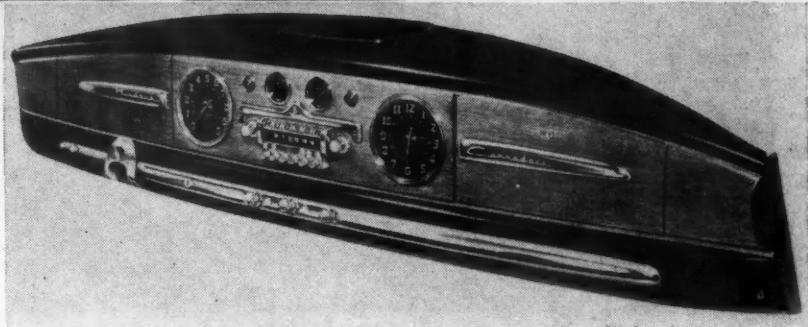
Hudson continues its well-known Drive-Master optional equipment, the variety of drive arrangements being suited to the needs of any driver. First is the standard equipment consisting of a conventional transmission and clutch. In this connection transmission ratios have been changed to give greater flexibility of operation. The standard transmission can be supplemented with a semi-automatic shifting arrangement by specifying the Vacumotive vacuum-operated clutch which permits manual gear shifting without manual clutch operation. In addition, an owner can specify the overdrive unit either with the standard transmission or with the vacuum-operated clutch mechanism. Overdrive controls too have been improved to give smoother operation.

When specifying the Drive-Master, an owner gets the complete package consisting of the Vacumotive



(Left) A "two-person" arm rest 16 in. wide folds down out of the rear-seat back cushion in Commodore sedans and six-passenger coupes.

(Below) New 1948 Hudson Commodore instrument panel



clutch in combination with the vacuum-electric transmission control, thus giving at will the following combinations—completely automatic drive without use of either clutch pedal or gear shift lever; Vacumotive—manual gear shifting without manual clutch operation; and conventional drive—manual shifting and clutch pedal operation. These can be obtained simply by turning the control lever on the instrument panel to the desired position. To supplement the standard Drive-Master set-up, the owner also can specify overdrive equipment.

With the current Drive-Master further refinements have been made to improve accessibility for servicing and for checking the operation of control elements as well as to facilitate initial installation at the factory. On the new models, the shifting cylinder for the transmission, the selector diaphragm for the crossover control, and the master switch or brain controlling the electrical system for all functions have been centralized in a unit mounting which is installed on the left side of the engine. The shifting cylinder and diaphragm are connected to the transmission by a simple linkage.

Hudson continues the use of its unique braking system—the four-wheel Bendix servo-action hydraulic brakes in combination with the mechanical reserve braking system which takes hold automatically before the pedal reaches the floor. Owing to the redistribution of weight, the six-cylinder models have large—11 in.—brake drums, making all drums the same size on all models. However, the lining is wider at the front and front wheel cylinders are larger than the rear to give greater braking effort. The master cylinder is mounted directly behind the brake pedal.

It is claimed that riding quality has been greatly improved through the change in mass distribution, in combination with the front independent suspension and semi-elliptic leaf springs in the rear. Direct-

acting shock absorbers are employed front and rear. Another feature contributing to better ride is the new Goodyear super-cushion tire which is of low-pressure, large cross-section type. It is said to absorb road shock, provide better traction and greater steadiness on rough roads.

Steering gear ratio has been increased to 20.4 to 1 to lessen steering effort. A new Gemmer three-tooth worm and roller mechanism is employed, the steering column shaft being ball-bearing mounted. The Center-Point steering linkage is continued.

Weather-Control, the combination heating and fresh air system which is claimed to provide a fog-free windshield in any kind of weather, is available as an option. It scoops outside air through a rain-proof cowl ventilator, filters and heats it to a controlled temperature. This arrangement in combination with a built-in defroster keeps the windshield free from fog. Defroster openings have been increased to make this action more effective.

Another interesting feature is the provision of jack pads on the frame adjacent to front and rear bumpers. At the front the pads are located on extensions of the front side rails; while at the rear they are located on the external frame rails at the tips of the rear bumper. This makes it possible to jack up the side at the rear at the extreme point of leverage, transferring weight to the wheels on the pavement.

The Monobilt body structure has an integral system
(Turn to page 70, please)

(Below) Facing disk of turbine blade and disk assembly for a Rolls-Royce jet engine

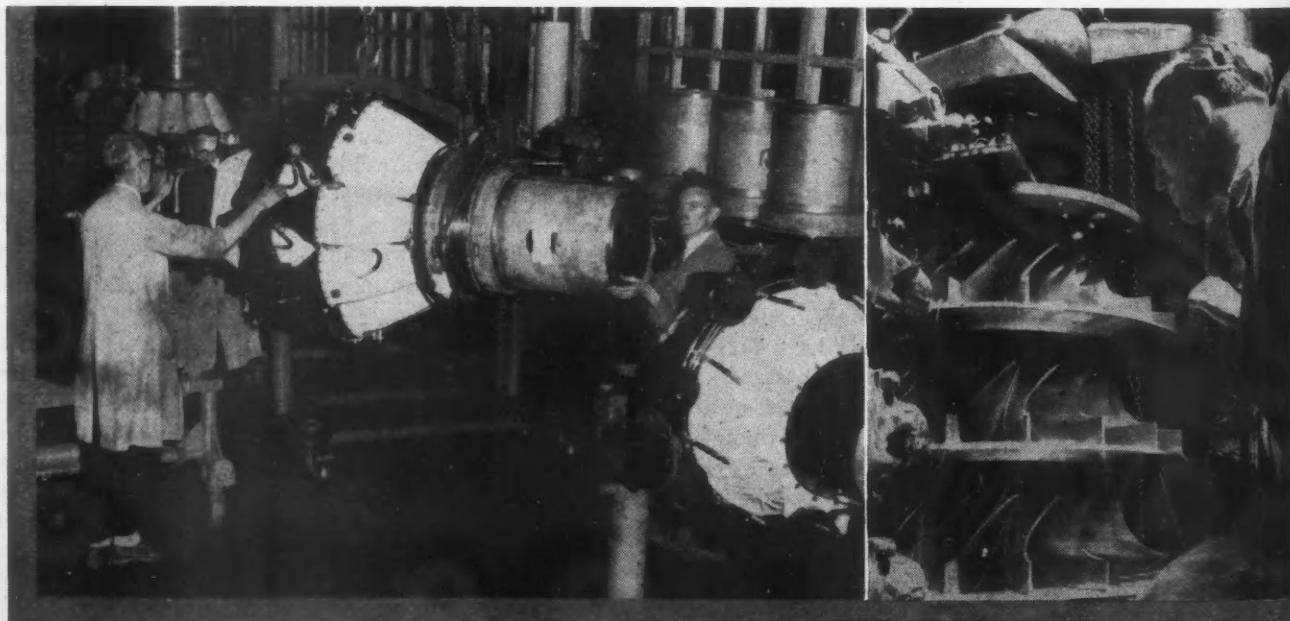


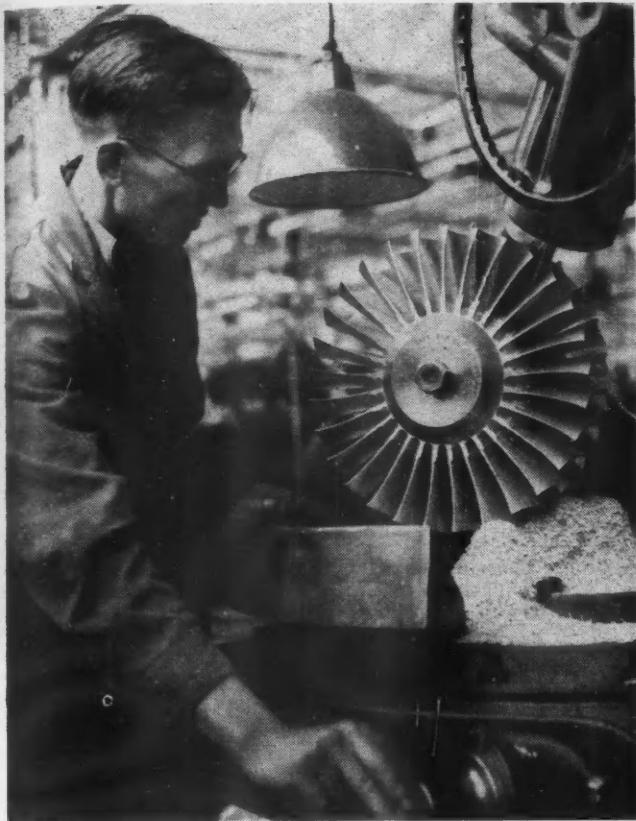
(Above) Machining a pair of rotating guide vanes for Nene jet engine

British Jet Engines

Lowering a Derwent V into a transporter stand at the Rolls-Royce works at Derby

Three impellers for Goblin gas turbines are machined simultaneously on this Keller machine





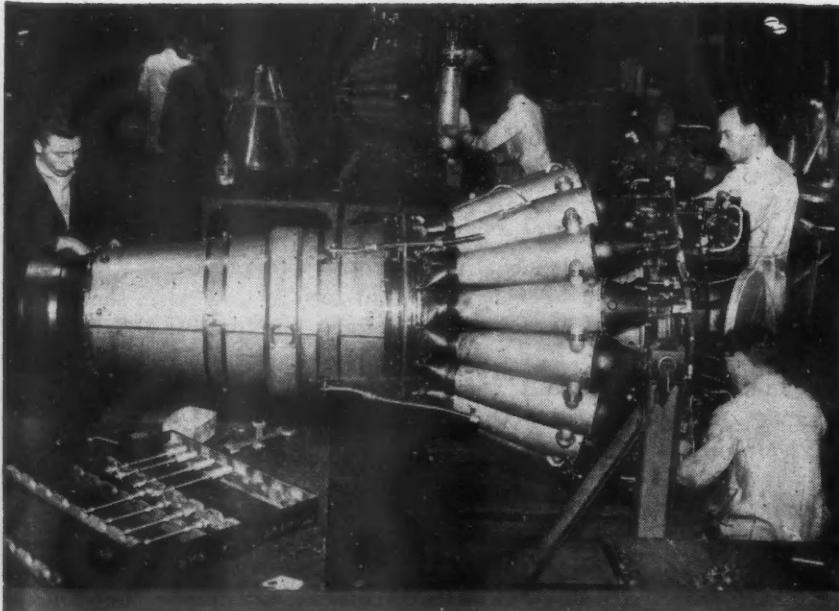
Milling rotating guide vanes for Derwent V jet engine



Examining the form of a milling cutter for producing the serrated root of a turbine blade for a Rolls-Royce jet engine. The image is projected on the screen at a 50X magnification

in Production

Goblin Mark II engine in the final stages of assembly at the de Havilland plant. It has 16 straight-through combustion chambers



SHOWN on these two pages are several interesting manufacturing operations on three British jet engines—the Nene and Derwent V built by Rolls-Royce and the de Havilland Goblin. The Derwent V, which develops a maximum static thrust of 3600 lb at sea level, powered the Meteor at 616 mph. With a Nene installed in it, a Lockheed XP-80 reached a speed of 580 mph. This turbo-jet engine has a maximum thrust output of 5000 lb at sea level. Four Nene engines will power the Tudor VIII airliner, which is scheduled to undergo its first flight tests soon in England. The maximum thrust of the Goblin is 3000 lb.

British Comline photos

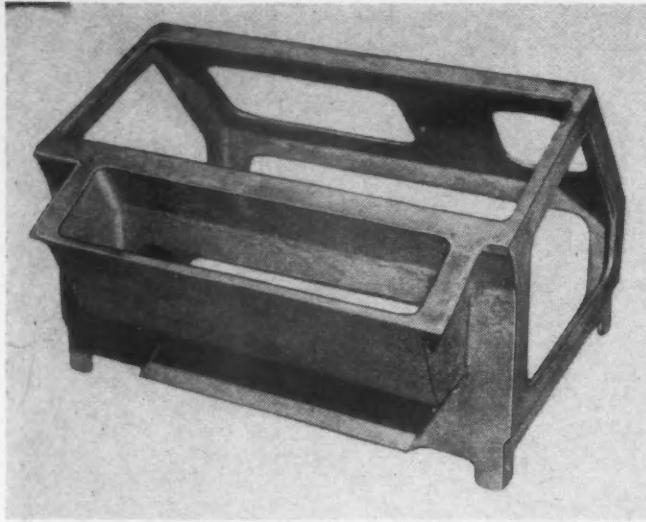


Fig. 1—This aircraft control mechanism housing was cast in natural bonded green sand with one synthetic bonded core. It was formerly cast entirely in synthetic bonded core sand, using a block for forming an impression in the sand to receive the baked cores. Results were not satisfactory with the latter method since there was no assurance that the cores would be placed correctly, and also because of difficulties encountered in slab milling. By redesigning the pattern equipment, it was possible to make the part by the natural bonded sand method.

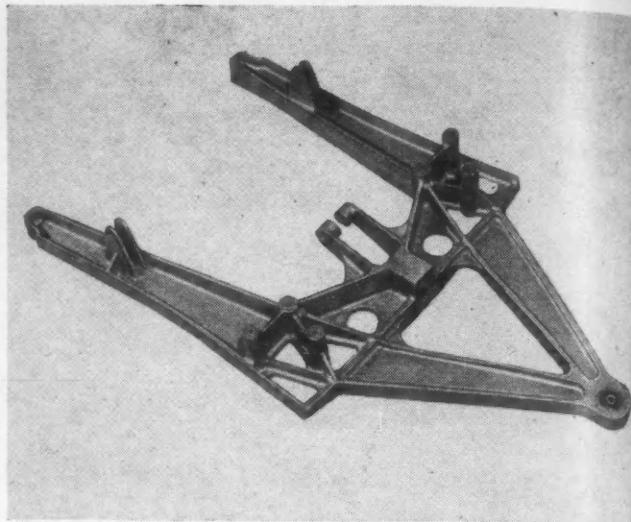


Fig. 2—This part, used in the tail fin assembly of the B-29, is illustrative of the cost saving achieved with precision sand casting technique. Use of this method eliminated machining operations and resulted in a saving of \$160 per unit. Total overall distance from the feet of the casting to the center of the bearing is approximately 36 in.

Applications of Precision

DURING the past few years precision castings and their methods have been advertised to such an extent that they are gradually collapsing under their own weight. This has been brought on by the fact that the sponsors of any given method have over-emphasized the possibilities of their own particular casting technique. All methods of precision casting have their own individual merit, however, and it is intended here to point out the potential possibilities of these various processes.

Natural Bonded Sand Casting

A natural bonded sand mold, as the word implies, has its own natural bonding agent, and only requires additional moisture to condition the sand to receive the impression and hold its shape against the shock of metal poured into the cavity. The permeability of the sand is altered for various types of metals poured, steel castings having a very coarse or open sand, and non-ferrous alloys a much denser and finer sand.

Inaccuracies of standard sand cast castings are due to poor foundry technique such as improperly rammed sand, loose and hard areas, and improper gating. The latter will allow the metal to go into the cavity with such force that it will reproduce imperfect areas and cause dimensional imperfections on the cast surface.

Precision Sand Casting—The Osbrink Process

Precision castings can be produced in all types of metals with sand. The sand, of course, must be varied for the type of metal to be cast. Precision sand casting, as in any other precision casting process, requires dimensional development of a pattern, allowing for the shrinkage so that the ultimate result is satisfactory dimensionally. Careful design of a tool will eliminate the human element insofar as core placement is concerned. Proper gating will produce surfaces that are equal to rough machine surfaces, will do away with the necessity of spot facing and milling of various cervices, and in general will eliminate 75 per cent of the machining.

It is sometimes necessary to get a deviation in design so that bosses that form undercuts in the pattern can be elongated, thereby eliminating the necessity of a core. Care must be taken in the design of the equipment so that dimensions that must have a close relation to one another are all cast on either the cope side of the mold or the drag side. Relationship of the dimensions cannot be held between the cope and drag to closer than plus or minus 0.010 in.

Cost for the Osbrink Process of precision casting is naturally higher than standard sand cast equipment because of the extreme accuracy necessary in the

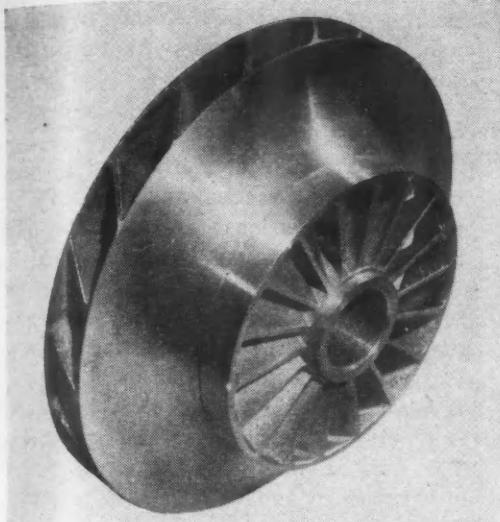


Fig. 3—The impeller shown in this photo, used in an aircraft cabin pressurizing system developed by the AiResearch Manufacturing Co., was made entirely by the Antioch process. Since the impeller travels at a high rpm, the air chambers had to be very accurate dimensionally. Also, some of the surfaces of the impeller were required to be free from imperfections prevalent in standard sand cast castings.

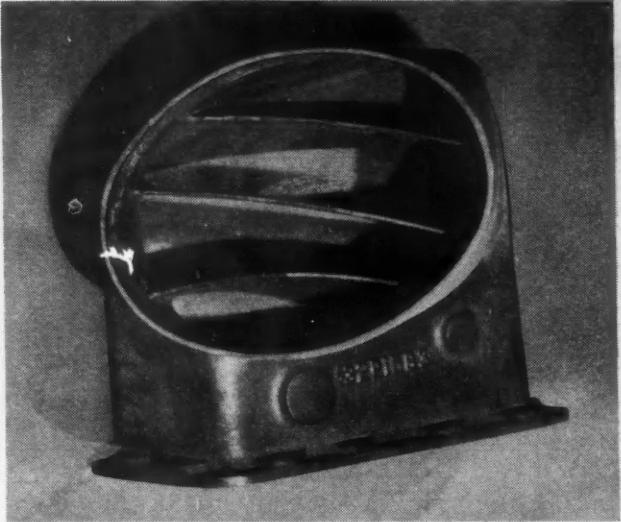


Fig. 4—The carburetor air scoop in this photo was cast using the Antioch method for the veins and housing interior, and sand for the housing exterior. Originally a standard sand casting with the veins riveted to the housing, this part was redesigned with cast-in veins to prevent the rivets from shearing under high vibration. The improved casting technique also reduced the final cost of the part.

Castings

By R. H. Osbrink

President,
R. H. Osbrink Manufacturing Co.

equipment to produce a part that will simulate machine castings. However, this method parallels die casting or permanent mold processes since it eliminates an accumulation of errors through the production of several models to maintain the final result.

Synthetic Bonded Baked Precision Sand Casting

Synthetic baked sand differs from natural bonded sand because a bonding agent is used in the place of the natural bond in addition to moisture, and is then formed into the shape desired and baked sufficiently to drive out all free moisture and obtain a material that is hard and strong enough to be handled. For steel castings, a very coarse, open grain sand is used to obtain permeability, and due to the high specific gravity it must necessarily be rammed hard enough to withstand the shock of the metal. Precision steel castings can be made, however, in synthetic bonded baked sand using a much finer grain sand which will allow reproduction of closer detail and, due to the fact that it has no free moisture, will permit the steel to lay against its surface without any turbulence of the

metal. Synthetic sand also has the advantage of being uniform in hardness and will therefore withstand, to a better degree, the shock of the metal. Again, by proper gating technique to reduce this shock, a casting more uniform in dimension will be obtained. This process, however, is more expensive than the natural bonded molding sand technique, and requires accurately machined core plates so that the impression made by the pattern is not distorted during the process of baking the core. In a large number of cases, it is necessary to use what is commonly known as a core drier in place of the core plate. Driers are used for irregular contours, and the degree of accuracy in the final product depends entirely on the accuracy of the core drier to conform to the correct contour.

Antioch or Plaster Molded Casting

Antioch is a patented process using plaster as a medium to receive the molten metal. In substance, the patent covers the method of producing a fine surface finish that is egg-shell in depth, with a coarse granular background, free of moisture. This coarse background allows for good permeability, and will not explode or erupt when materials such as aluminum alloys or alloys with a lesser melting temperature are poured in the cavity.

This process is particularly adaptable to casting designs that require a multiple of cores in order to overcome undercuts and back-drafts. Owing to the nature of plaster in its green state, it can readily be seen that any number of formed cores could be assembled and, if necessary, disassembled and re-assembled many times without distorting those areas that form the locking fits to produce accurate dimensions. In this

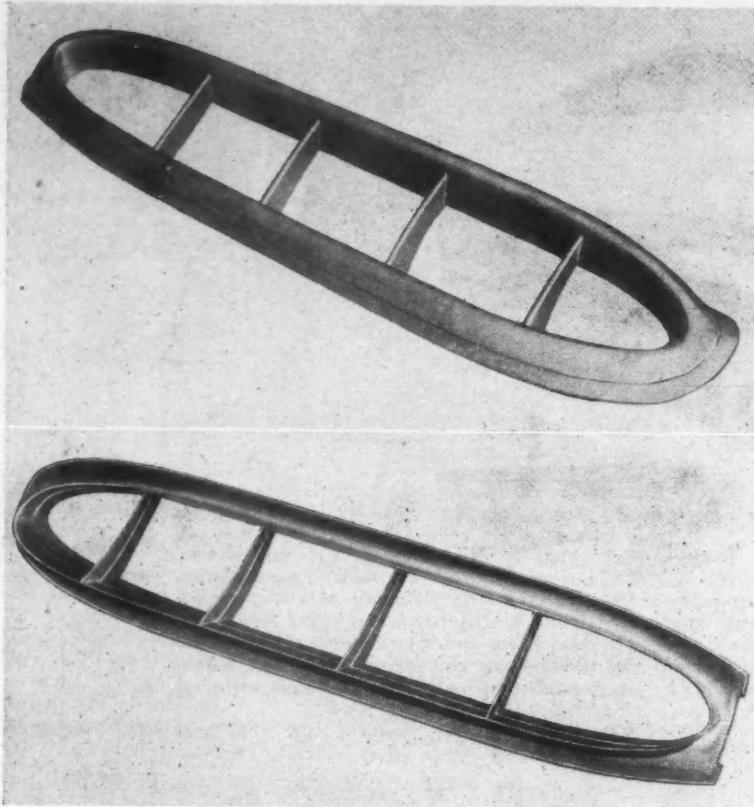


Fig. 5—This part, which was designed for the intake area on the leading edge of the Ryan Fireball, is a good application of the Antioch process of precision casting. It measures approximately 36 in. overall with wall thickness of 0.062 to 0.072 in., and vertical members approximately $\frac{1}{4}$ in. thick. The skin line offset on the outside and inside contour was controlled within plus or minus 0.0005 in., and the offset on the overall dimensions within plus or minus 0.015 in. The mold was made up of seven Antioch cores which were locked together in the green state and then processed after assembly. Gating technique played an important part in the production of this casting since an improperly designed gate would have created a stress in the grain structure which would have caused the part to warp after heat treatment.

respect Antioch process differs greatly from synthetic bonded baked cores because of the nature of the sand being such that, once assembled and then for some reason disassembled, the abrasive action of one part on another would change the size, thereby creating a chance of mislocation on the final parts. Antioch process is particularly necessary when the engineer desires very thin cross sections. Asbestos is used as a bonding material for strengthening the plaster. This, along with the natural characteristics of the plaster, creates an insulation, therefore allowing slow solidification. It is possible with this process to run thinner sections a greater distance than by any other gravity poured method.

The process lends itself to comparatively inexpensive tooling for proof engineering parts of intricate design; however, for production of parts by this method, the tooling cost is considerably more expensive than standard sand casting equipment. During the processing of the plaster it is necessary to steam cook the plaster for a number of hours at 15 psi pressure. At this stage the plaster is very flexible and will follow any discrepancies on the contour of the equipment holding it in place during cooking, thereby

making it subject to the same problems as are embodied in the synthetic bonded core sand process.

Lost Wax Process

There are several methods of tooling the lost wax process, and two will be used as illustrations; rubber mold, and the low-temperature alloy metal mold.

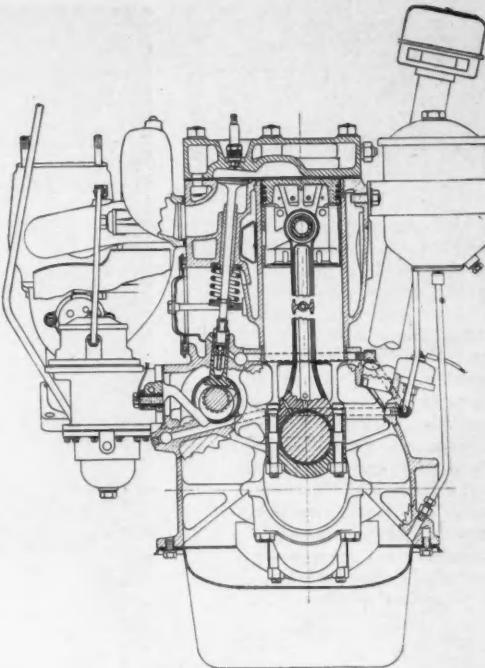
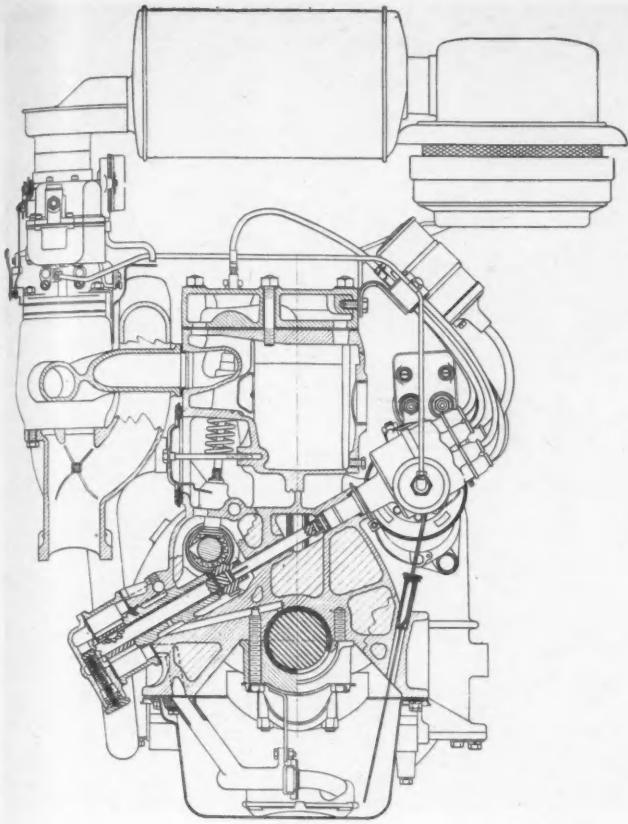
When there are a great number of severe undercuts which will not permit the removal of the wax facsimile from a two part mold, the rubber mold method is used. Rubber of a very flexible nature is employed for making this type mold. The rubber is vulcanized around the metal pattern and then divided into two parts, using a very sharp knife for tracing the undercuts. This will allow the thread-like rubber to be removed from the undercuts and then, due to its flexibility, to return to its original shape. When the two parts are placed together, they form a cavity that is a duplicate of the final part to be cast. Wax is then injected into this cavity. After the wax has solidified, the rubber mold is peeled off, giving a wax facsimile of the original part.

It can be seen that in this process there is a possibility of discrepancy from one part to another, the amount of discrepancy depending largely on the shape and size of the part. This method of molding is used in the jewelry industry with exceptional results where most interest is placed in reproduction of detail than in exact dimensions. This process would lend itself to the industrial field

if the designer recognized these dimensional deficiencies and could allow for them in his design.

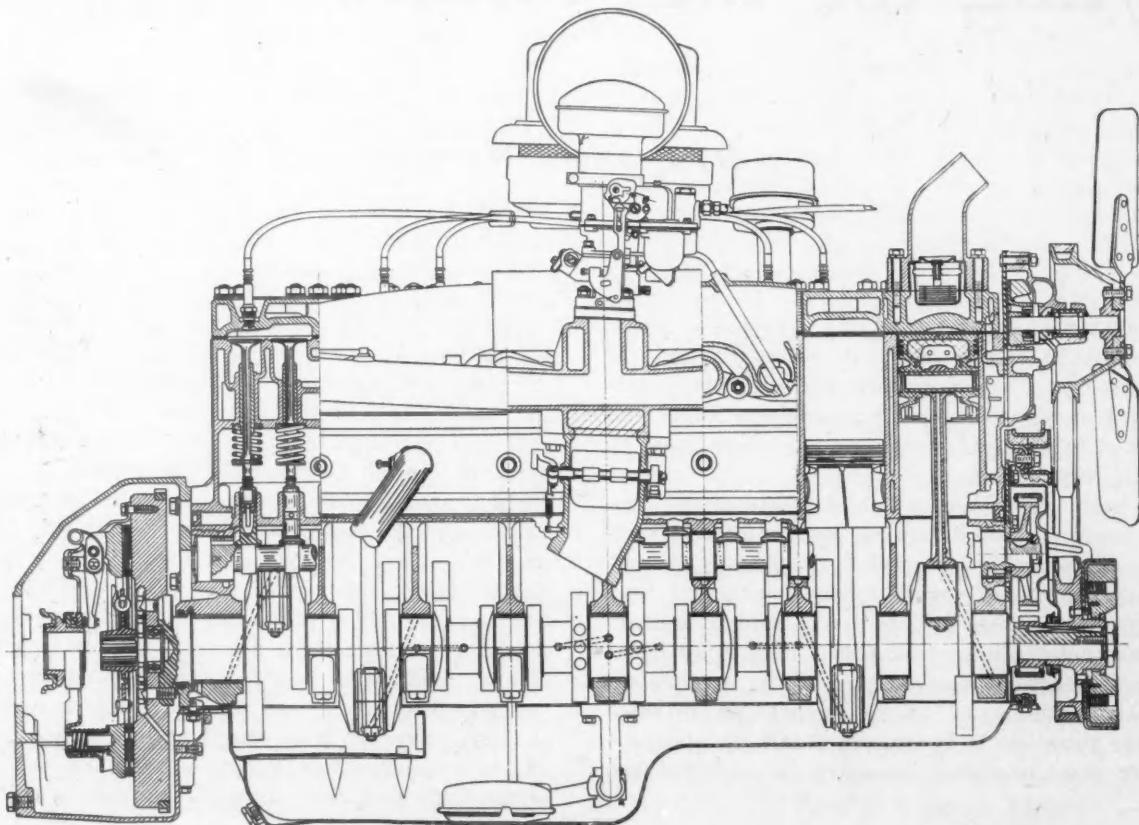
A much more accurate method is the low-temperature alloy metal mold. These molds, in substance, are die casting dies. By using the low temperature alloy, the cost of producing the mold is a great deal less than the usual method of die sinking. In fact, the production of the die itself after the metal pattern is made is only a few hundred dollars. However, accuracy in reproduction with this method is determined largely by the wax model required for the use of the mold. Parts that have non-uniform cross sections are difficult to reproduce inasmuch as it is not possible to get progressive solidification. This will cause shrink spots in the heavy areas. It is practically impossible to obtain a wax casting without some shrink on the surface. This may be only a matter of a few thousands, but the same problem is embodied in the final part, therefore accumulating the discrepancies. The wide variance in shrinkage in one given lot of wax, plus the variance of expansion in the investment, tend to discount the close dimensional tolerances that have been claimed in this process. This method has proved very

(Turn to page 62, please)



SHOWN here in longitudinal and transverse sectional views is the new Packard 1948 Custom Eight engine, complete details and specifications of which were given in the Nov. 15 issue (page 43) of AUTOMOTIVE INDUSTRIES. This 356 cu. in. engine has a 3½ in. bore, 4½ in. stroke and a maximum output of 160 hp at 3600 rpm. New features include the adoption of a seven to one compression ratio through the use of new cylinder heads, and a nine-bearing crankshaft.

Packard Custom Eight



In the experimental design studio, stylists create automobile designs, paying attention mainly to the aesthetic value, and to some extent, disregarding practical problems. The main purpose is to indicate possible future trends. As a result, many of the models created here never leave the "green" stage, but none the less some of the ideas they incorporate eventually find their way into production models.



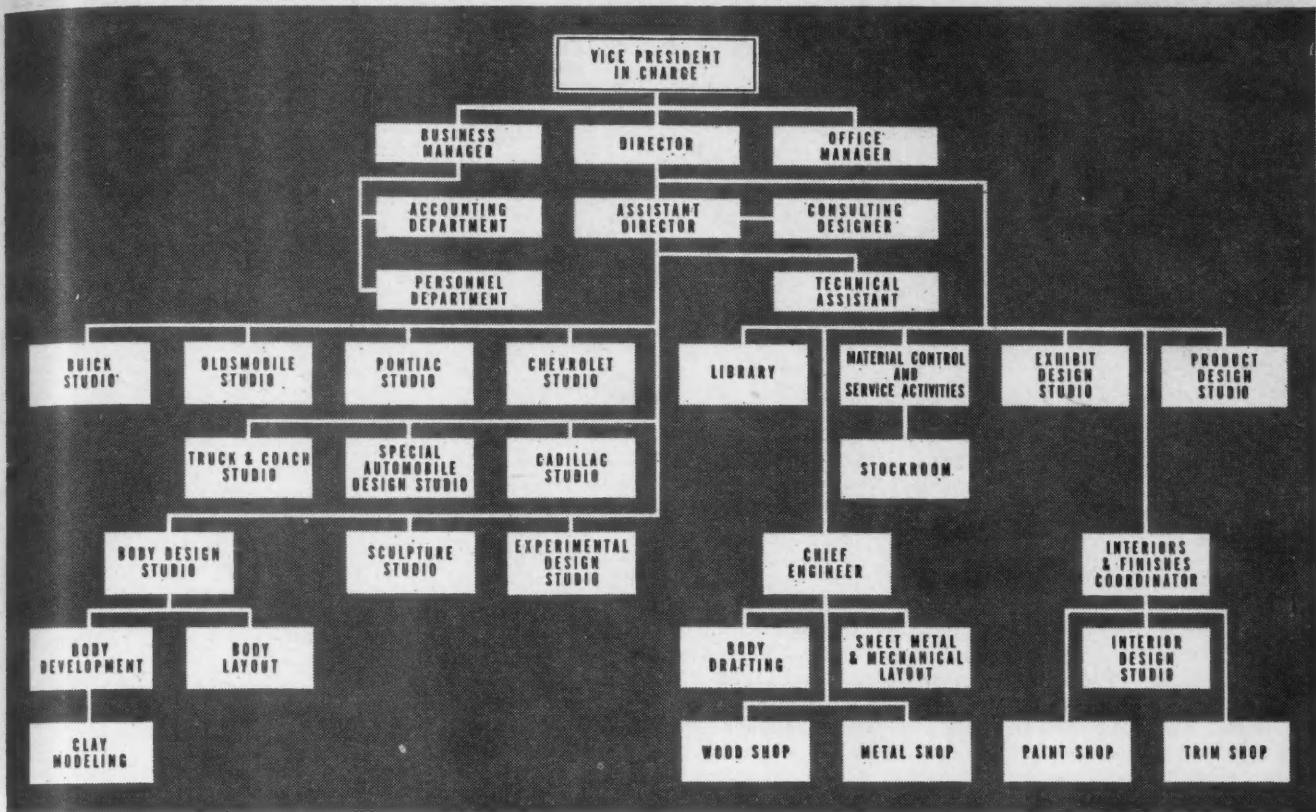
Styling for the Future

By Leonard Westrate

PROBABLY nothing is so obvious in results or more obscure in origin than automobile styling. It is the first thing that meets the eye of the average individual, yet he probably knows less about the mysteries of bringing it about than any other phase of automobile engineering.

Not so many years ago, the chief assets of an automobile were its power, stamina, and ability to keep running. Early cars resembled the family buggy which they supplanted, and for many years, style was secondary. While some attention was paid to appearance it was not the important factor it is today. But with the increasing improvement in the mechanical functions and the rise of intense competition for sales in the late twenties, it became increasingly apparent that more emphasis was necessary on external appearance.

General Motors claims the first effort to put styling of automobiles on a major footing in any automobile company was made when it organized a styling section in 1927. Prior to that time, what styling work there was had been done by the various automobile divisions and by Fisher Body. GM recognized that to the owner, an automobile was a personal possession occupying in his esteem a place second only to his home and that it must express individuality, style, and good taste. Major sponsors of that philosophy were Alfred P. Sloan, Jr., then president, and Fred and Lawrence Fisher who then were active in the management of Fisher Body. As a result, the styling section was born in May, 1927, and its first employe was Harley J. Earl, currently vice president in charge of styling. He had designed the LaSalle car for Cadillac the previous year and then agreed to organize the styling



Organizational Chart of General Motors Styling Section

section for the corporation. Since that time the organization has grown to more than 300 persons, and its function still is basically the same—to bring together the science of the engineer and the skill of the artist to make the automobile as beautiful as it is useful. In addition, the styling section embraces design of industrial exhibits and also has a hand in styling other products built by GM, a notable example being the Train of Tomorrow.

One of the first difficulties faced by the new department was the paucity of personnel trained to do the type of work required. There were few if any industrial designers available, so the only recourse was to train a staff in the many skills required for the highly specialized business of styling automobiles. And that basic policy of training still is in effect today in the styling section. A strong believer in the energy and flexibility of youth, Mr. Earl still advocates attracting younger men of ability and then letting them prove themselves and their ideas. A related problem is an adequate supply of craftsmen who can translate ideas and drawings into realities of wood, clay, metal, rubber, and plastics. It is a difficult problem today, when the number of skilled artisans of the old school is diminishing rapidly, but it is met by a comprehensive program in which young men with ability are brought in and given long and careful training in the fine art of craftsmanship. A careful check is kept on retirement ages so that a replacement always will be available for retiring craftsmen.

One of the early accomplishments of the styling section was the development of a technique to build a complete clay model, something which had not been done previously. Thus, it was possible for the first time to make a faithful replica of the projected model which enabled the designer to view the car as a whole, rather than in component parts, an important development for judgment of harmony and balance.

Throughout its 20-year history, the styling section has contributed other important firsts to automotive design. Timing always has been important in introduction of innovations, and the section has ever been committed to the proposition that evolution of styling is much sounder than revolution. Another very important consideration at GM is the avoidance of "accelerated obsolescence." It has always been the policy not to make sharp departures from previous styling in order not to obsolete previous models to a degree that would mean a substantial loss to the owner in depreciated value.

Among the design advancements for which GM styling claims credit are such innovations as the built-in trunk, chrome moldings, radiator grilles, built-in headlamps, double tail lights, built-in running boards, bent glass for rear window contour, decorative bumpers, and many others. The department also made a signal contribution to manufacturing economy when it was instrumental in introducing a system of three basic body types which are used interchangeably between

(Turn to page 72, please)

Airbriefs

by Robert McLaren

Sonic Barrier Doomed?

Engineers and research men are convinced that the new Douglas D-558-2, second version of the Navy-Douglas-NACA research program into piloted sonic flight, will achieve (and possibly surpass) the speed of sound promptly. The first version, Douglas Skystreak, was not designed to attain sonic speed, although its world's speed record of 650 mph is the closest an airplane has ever approached the speed of sound in official tests. The new Douglas was designed from scratch for the express purpose of flying faster than sound and its swept wing, swept tail, pointed nose, thin wings, smooth fuselage and terrific power all but guarantee the mark. It is powered by a Westinghouse 24C turbojet engine for takeoff and climb and a Reaction Motors rocket engine for accelerating through the barrier. A major feature is a detachable nose, which is blown loose from the airplane in emergency. Once free, the pilot then leaves the nose after it has slowed to a speed safe for opening a parachute. While the winter temperature at Muroc Air Base in the great California desert goes down around the freezing mark, hot days occur any season and the first 90-100 F day that comes along the Navy will try out its new research vehicle. This high temperature permits the airplane to attain a higher ground speed before the serious effects of compressibility manifest themselves in high drag, instability and intake choking.

Roadable or Flyable?

The problem of the "car-plane" has been divided into two schools of thought through the years: whether it should take the form of a "roadable airplane" or a "flying automobile" and the difference between the two is considerable. Through nearly 40 years of experiment on the idea the major emphasis has been on the airplane which could navigate on the ground. A radical departure is the design recently tested by Consolidated Vultee Aircraft Corp. in which a conventional sedan of modern lines has been equipped with

a separate wing and power plant assembly for use in the air. The automobile is powered by a Crosley engine mounted in the rear. The front of the car is of conventional form, but contains only a luggage space. The airplane assembly consists of all-metal wings and a tail supported on a boom. The power plant is a 190 hp Lycoming engine. This assembly is carried on four bolted fittings in the roof of the car. The announcement of the new design was marred by its crash near Vista, Calif., when it ran out of gas due to gages that had not been calibrated. Lawrence Phillips, the pilot, was not seriously injured and the automobile sustained the impact remarkable well. Convair spokesmen say only a luggage panel and a new door are required to resume test flights in a few weeks. The possibility persists that the newly organized Nashville Corp., formed to accommodate Avco Mfg. Corp.'s interest when Atlas Corp. acquired control of Convair, may manufacture the automobile with the airplane assembly optional.

Ramjet Helicopter

The jet helicopter idea has intrigued helicopter designers since jet propulsion first proved successful, the appeal being in the total absence of torque when the power is delivered within the blades themselves. A major promise of such a system lies in the large size helicopters in which the weight and complexity of the rotor head is increasing disproportionately with the size of the useful load. The Air Force has revealed successful tests on a ramjet system developed under contract with McDonnell Aircraft Corp., St. Louis, Mo. The ramjet is simply a properly shaped tube through which air is forced by its movement and into which fuel is introduced for combustion, which provides thrust. Only drawback to the system is the fact that the forward speed provides the required compression prior to combustion and the ramjet pressure ratio (outside air to inside air) is quite low at subsonic speeds, resulting in inefficient combustion. High speeds would produce efficiency losses in the rotor blades. A

proper balance between these two speeds is required and McDonnell engineers are experimenting with a wide range of speeds, ramjet sizes and blade diameters. "Little Henry," the flying test rig used by McDonnell, has been flown to date on propane, but gasoline will be used eventually. The device has lifted its own weight, which is a 100 per cent improvement over conventional reciprocating engine designs.

Pack Plane

Fairchild Aircraft Division, Fairchild Engine and Airplane Co., is developing a version of its famed Packet design with a detachable cargo carrier and the Air Force has established a design project at Wright Field on the idea. Advantage of the detachable fuselage is that it cuts to a minimum the time the plane must be on the ground for unloading and loading. The military visualize a shuttle service in which the "Pack Plane" could fly into the forward area with mortar shells, for example, and pick up a pack containing wounded troops. Cooperating in the idea is Hodges Research Corp., which is developing a standard container adaptable to air service aboard the "Pack Plane," shipment on a railway flatcar, on a truck bed or even on its own wheels as a truck trailer. In this manner cargo requiring air conditioning could be loaded into the container and complete its journey direct to its destination (by air, train and truck) without disturbing its contents.

Track Trucks

Another indication of Fairchild leadership in the cargo aircraft field is its newly-developed tractor landing gear installed on a C-82 Packet. The gear consists of a wide rubber tread running on rollers. Fully retractable, the tricycle gear presents no additional drag in flight. The gear solves two major aircraft problems, distributing the concentrated weight of the airplane over a considerably larger area and permits the airplane to operate into unimproved landing areas. The gear, first tried experimentally during the war on a smaller Douglas A-20 light bomber, increases the utility of the cargo plane by permitting it to operate closer up to combat zones. In combination with the "Pack Plane" idea, a bulldozer could be air landed by a tractor-gear equipped plane, following which a larger area could be cleared for larger conventional aircraft. Army Medical Corps is redesigning much of its field hospital equipment for transportation installed and ready-for-operation in a detachable container for the "Pack Plane."

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Important Tariff Concessions in Geneva Trade Agreement

By Eugene Hardy

*Continued from December 1 Issue of
AUTOMOTIVE INDUSTRIES, page 86*

UNION OF SOUTH AFRICA—Concessions on automobiles included the assurance that the specific duty on lower priced automobiles (now 23s. per 100 lb) would not exceed 20 per cent ad valorem; and the top price in this classification was increased from f.o.b. SA £400 to f.o.b. SA £600. The second classification of motor cars with an f.o.b. value of SA £400 to SA £600 with a duty of 25 per cent was increased from SA £600 to SA £800, while the third classification of f.o.b. value of SA £600 at 30 per cent was increased to f.o.b. value exceeding SA £800. The low existing rates of five per cent and three per cent on motor trucks were bound against increase. Parts and accessories for both automobiles and trucks were bound at 20 per cent. Airplanes were bound on the free list.

The duty and preference of 9s. 6d on tractors, other than the mechanical horse type, was eliminated and this item placed on the free list. The duty and margin of preference on mechanical horse type tractors was reduced from 10 per cent to 5 per cent.

United Kingdom Cuts Rates

UNITED KINGDOM—Under the category "motor vehicles," reductions were granted in the rate on motor bicycles and tricycles amounting to approximately one-third, the margin of preference being eliminated entirely. Duties for automobiles of 25 hp or more were bound at the existing rate. The rates on agricultural tractors were bound at the present rate of 15 per cent ad valorem and the margin of preference was eliminated. The duties on imports of track-laying tractors were decreased by 25 per cent in one case and 40 per cent in another according to the drawbar horsepower.

Regarded as the most comprehensive international instrument ever negotiated for the reduction of barriers to world trade in regard to the scope of its provisions and to the volume of trade which they affect, the agreement will be put into effect provisionally on Jan. 1, 1948, by Australia, the Belgium-Netherlands-Luxemburg Customs Union, Canada, France, the United Kingdom and the United States, and by the other participating countries as soon as practicable. This must be done

by June 30, 1948. Any nation may withdraw from the agreement, upon giving six months' written notice, at any time after Jan. 1, 1951. The entire agreement covered some 45,000 items and of these the United States granted or received concessions on about 3500 to 4000 items.

Each participating country agrees to grant to the other parties in the agreement the reductions or bindings of tariff treatment specified in the schedules of tariff concessions, and to observe the rules laid down in the general provisions in its commercial relations. Generally, concessions granted by the United States will not be limited to the 23 participating nations, but will apply to all American foreign trade under the most-favored-nation clause. American producers are also protected by an escape clause, under which a concession may be withdrawn or modified if imports increase so sharply as "to cause or threaten serious injury to domestic producers."

Syro-Lebanese Reduction

S Y R O - L E B A N E S E C U S T O M S UNION—A major concession made by the Syro-Lebanese Customs Union was an undertaking to eliminate the existing differential duty treatment which provided much higher duties on passenger automobiles (imported chiefly from the United States) than on lighter automobiles (imported chiefly from countries other than the United States). A provisional rate of 140 piasters per kilogram was established, replacing a range of duties with a higher maximum, based on horsepower and weight. Duties of 25 per cent on automobile parts and engines, and on motorcycles and parts were bound, while 60 per cent reductions were granted on airplanes, parts, and engines. The rate on tires and tubes was reduced from 25 per cent to 15 per cent ad valorem.

The rate on tractors was cut by 60 per cent. The duty on tractor parts was bound. Agricultural machinery was bound provisionally on the free list and parts for such machinery were bound at moderate rates.

While tariff negotiations were conducted on a selective, product-by-product basis with the country which was a principal supplier of that product,

each participating nation will receive the benefit of each of the concessions granted by all the nations. Of equal importance with the tariff concessions are the general provisions of the agreement which establish for the first time a generally accepted international code of fair treatment in commercial relations.

Under these provisions, the most-favored-nation clause is incorporated in its unconditional and unlimited form. A blanket limitation on preferences, such as those maintained between the areas comprising the British Empire, is also included. These preferences may not be increased beyond levels in effect on a date prior to the agreement.

The most-favored-nation provisions of the general agreement also extend to export taxes. From the point of view of the immediate interests of the United States, a significant result will be the elimination of the discriminatory tax on exports of tin ore and concentrates from the Malayan Union. When Malaya puts the agreement into force, any tax thereafter maintained on exports of tin ore and concentrates must be the same for all countries, irrespective of destination, and the United States smelting industry will be in as favorable a position as the smelting industry of any other country in obtaining access to tin supplies in Malaya. There are no exceptions to the provision for most-favored-nation treatment on export taxes.

Other Provisions

Other major portions of the general provisions are as follows:

1—Internal commodity taxes which apply to imported products must apply equally to like domestic products; internal regulations in general may not treat imported products less favorably than domestic products; and any internal quotas or "mixing" regulations must not restrict imports to an extent greater than they did on April 10, 1947, and must be subjected to negotiation for their further limitation or elimination.

2. Special transit duties or other restrictions are prohibited and all regulations dealing with transit must be reasonable.

3. Antidumping and countervailing duties are limited to specific purposes.

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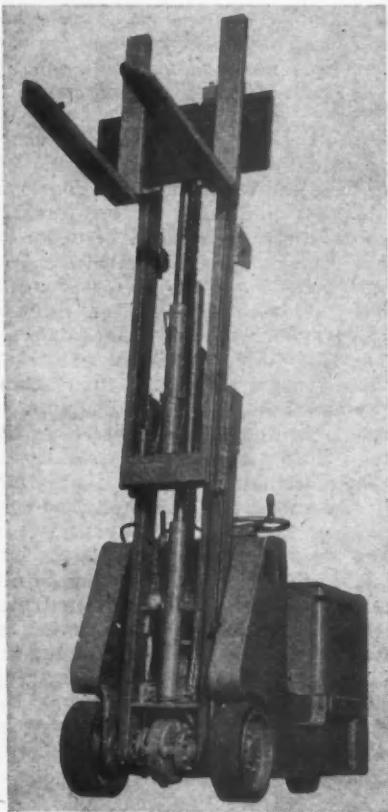
NEW Production and Plant EQUIPMENT

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E-223—Fork Truck for High Lifting

The Skylift Brawny, a new fork truck for handling loads of 4000 to 8000 lb is announced by Automatic Transportation Co., 149 W. 87th St., Chicago 20, as the latest addition to its line.

The Brawny is said to offer lifting heights never before achieved by trucks



The Skylift Brawny

of its capacity and yet will tier to ceiling heights in box cars and low-clearance buildings. It features the Newmatic controller, which functions as the electric counterpart of an automotive automatic gearshift; Automatic's new high-pressure hydraulic system, and silicone insulation and lubrication. The Skylift Brawny is the first truck in the 4000- to 8000-lb range to incorporate such advantages in its design.

With a standard collapsed height of 83 in., the 4000-, 5000- and 6000-lb trucks lift to 124 in. The 7000- and 8000-lb models lift to 115 in.

The Brawny's hydraulic lift telescopic action is engineered so that the forks and uprights are raised independently by separate rams. The forks thus raise to 62½ in. before the uprights begin to extend.

Power steering is available on the

truck at the option of the buyer. The manufacturer states that the manual steering assembly operates so easily, however, that power steering is not needed or recommended for most operations, especially on the three smaller models.

E-224—Centerless Grinding Machine

A new model Filmatic No. 2 centerless grinding machine has been announced by Cincinnati Grinders Inc., Cincinnati 9, Ohio. Design features include straight hydraulic grinding wheel truing, with arrangement for cam controlled profile truing, if desired. The regulating wheel truing unit is manually operated, screw propelled. However, it can readily be replaced with a hydraulically operated unit, arranged for profile truing, as required for some types of in-feed work. Regulating wheel speeds are changed by lever operated sliding gears. Twelve speeds are available, from 12 to 300 rpm. A centrifugal motor driven pump, mounted in the tank at the rear of the machine, circulates the coolant. An individual stream of coolant is directed to the truing diamond by means of the three-way valve in the coolant line.

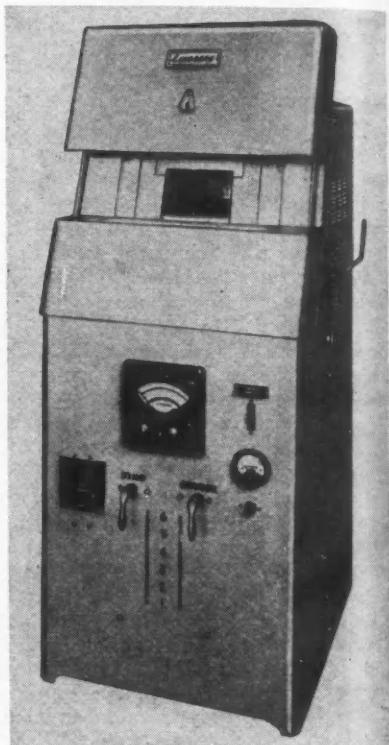
The regulating wheel spindle is now mounted on Filmatic multi-shoe bearings like those on the grinding wheel spindle. In conjunction with Filmatic bearings, both wheel spindles are automatically lubricated. A pressure switch in the grinding wheel spindle lubricating system automatically stops the main drive motor if the oil pump should fail.

Many attachments are built for these

machines, including long bar grinding, plastic tube and rod grinding, hopper feed units, magazine loading devices, etc.

E-225—Box Type Laboratory Furnace

A new box type laboratory furnace with temperatures up to 3000 F top heat, and for continuous operation as high as 2500 F has been developed by Lindberg Engineering Co., Chicago, Ill. This self-contained unit may also be



Lindberg furnace

used as a muffle furnace, or with carbon blocks for non-oxidizing atmospheres. The 3000 F top heat capacity provides heat at any lower level more quickly, and the ten silicon carbide "Globar" heating elements are said to insure uniform heating.

Furnace temperatures are regulated

Cincinnati No. 2 centerless grinding machine

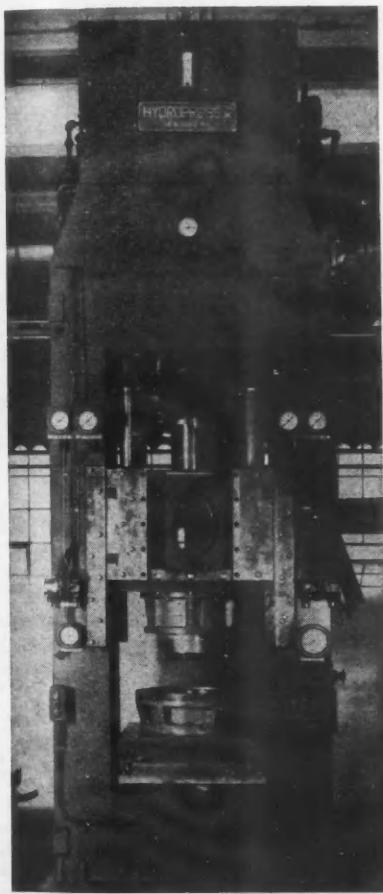


by an indicating-controlling pyrometer with an electronic circuit.

Model G-10 is designed for operation on 230 volts, 60 cycle, single phase a-c. Special voltages in a-c will be made to order. The variable voltage transformer, which is contained within the unit, has a capacity of 8 kw and is used in conjunction with the two tap switches, each of which have six control points for voltage regulation.

E-226—High Speed Drawing Press

Hydropress, Inc., 570 Lexington Ave., New York, N. Y., has designed and manufactured a new high-speed deep drawing press. It is of the self-contained oil hydraulic type and operates at very



Hydropress deep drawing press

high speed. The press frame is a box-type all-steel, one-piece weldment of rigid construction in which the cast steel main and blankholder cylinders are inserted.

The complete oil hydraulic drive with pumps and motors is mounted on the press proper. Push buttons are provided which actuate the valves by means of solenoids. Control of the press is manual, semi-automatic or full-automatic.

The main slide has a capacity of 100 tons while the capacity of the blankholder slide amounts to 50 tons. Both slides may be coupled together to obtain a total capacity of 150 tons for sin-

New Production EQUIPMENT and Plant

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gle action work. Depending on motor size, drawing speed can be obtained up to 225 ipm, at pressures up to 100 tons on the main slide, and fast advance and return speeds up to 1200 ipm.

E-227—Transfer Machine

A new special machine tool which produces 150 rear axle housings hourly with one operator has been designed and built by the Cross Co. of Detroit, Mich. This Transfer-matic consists of five two-station, double-end machines in combination with a unique transfer mechanism. The operations are rough and finish boring the wheel bearing seats, turning the outside diameter of the end flanges, turning the bolt clearance behind the end flanges, rough straddle facing and finish facing the end flanges.

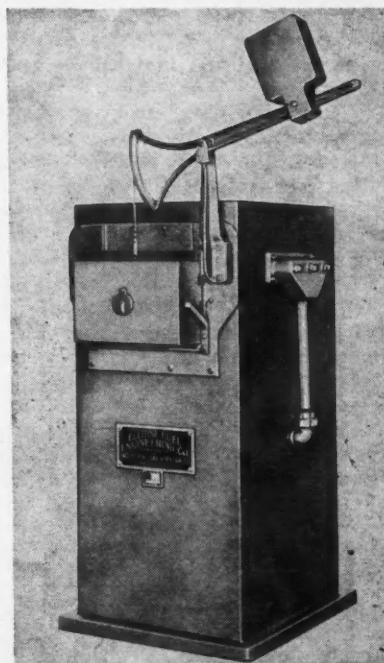
Performing in automatic cycle, the parts are picked up by the transfer mechanism, advanced from one machine to the next, located, clamped, and machined. In all, 20 parts are transferred simultaneously. The transfer mechanism moves the work from machine to machine only. Locating and clamping are left to the work-holding fixtures which are integral with each individual machine. To save time, the transfer mechanism lowers out of the way and returns to the loading position during the machine cycle. The operator has only to load the parts and press the cycle start button.

Coolant and chips are handled through a centralized system located beneath the floor. An idle station is provided between each of the machines for accessibility and to allow for the removal of parts between operations if desired. Cross standard self-contained units are used wherever possible to provide maximum flexibility for future de-

sign changes. Carbide tools, hydraulic feeds, and hardened and ground steel ways are used throughout.

E-228—Heat-Treating Oven Furnace

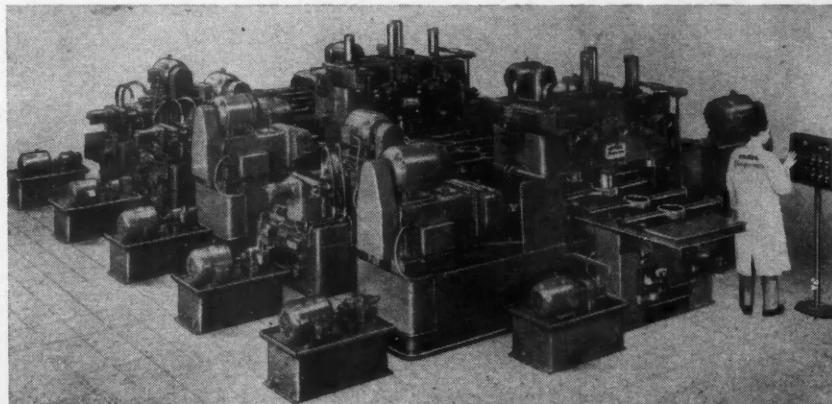
In its new 814-16 series, Eclipse Fuel Engineering Co., Rockford, Ill., offers a completely modernized version of its high speed oven furnaces. Units are fully enclosed. A streamlined body has



Eclipse gas-fired oven furnace

been designed to fully house all working parts.

Eclipse gas-fired oven furnace No. 814-16 is offered in two temperature ranges, 1400 to 1800 F and 2000 to 2500 F, to meet the varied demands of



Cross Transfer-matic

NEW Production and Plant EQUIPMENT

For additional information regarding any of these items, please use coupon on page 56.

heat-treating carbon tool steel, alloy steel and high speed steel.

Advantages claimed for this oven-furnace are good uniformity of heat distribution, low heat loss and quick heat-up time.

E-229—General Purpose Gear Shaper

A new 36-in. gear shaper has been placed on the market by The Fellows Gear Shaper Co., Springfield, Vt. This machine has been designed for general-purpose gear cutting, is of massive construction, and is adapted to the cutting of external and internal spur and helical gears.

The large one-piece cutter-spindle is designed to carry a five-inch cutter, and is operated by a heavy and rigid reciprocating mechanism. The saddle carrying the cutter-spindle and guides is also of heavy design with "square-lock" gibbs, and is rigidly supported on the bed.

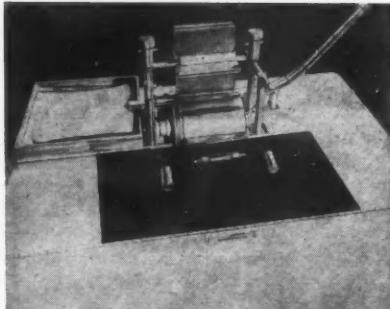
The apron carrying the work-spindle which has a $5\frac{1}{8}$ -in. straight hole, is supported in the base integral with the cabinet. The apron is positively locked in the cutting position by a new-type relieving and locking mechanism, and the relieving cam can be changed without removing the crankshaft. Additional support is also provided for holding the apron when it is opened to load and unload large gears.

Another innovation is the large range

of feeds and speeds available. Twelve different reciprocating speeds ranging from 18 to 300 strokes per minute are obtainable through a selecting dial located at the front of the machine. Four rotary feeds are available through a transmission controlled by a feed shift lever. Additional feeds are obtained by changing two "pick-off" gears.

E-230—Automatic Feed Attachment

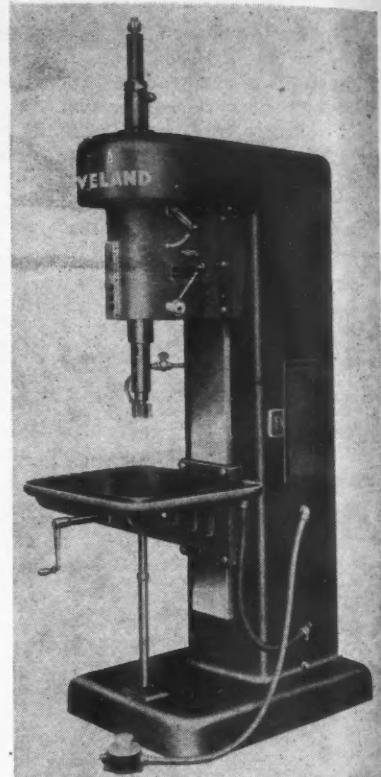
An automatic feed attachment is offered by the Size Control Co., Division of American Gage & Machine Co., 2500 Washington Blvd., Chicago, Ill., for use



Size Control Company's automatic feed attachment

on the company's centerless lapping machines.

Feeding, holding, and ejecting are



Cleveland model E tapping machine

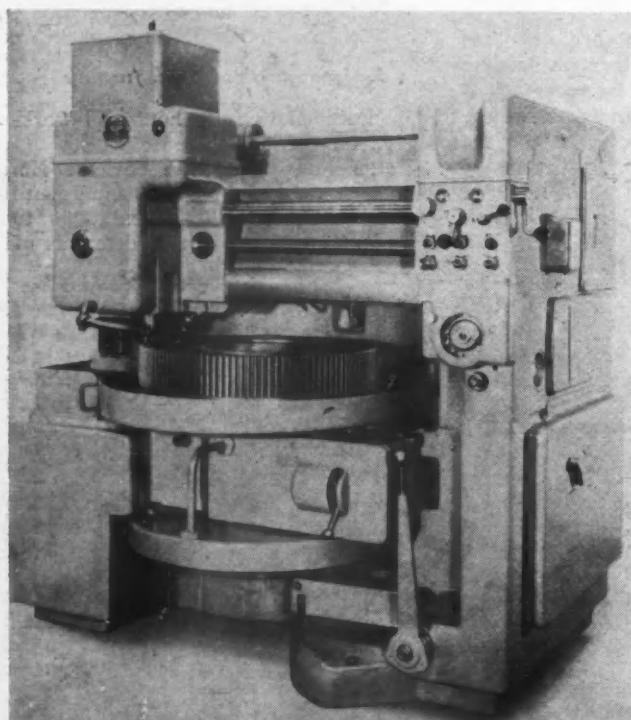
accomplished automatically. The operator, after adjusting tension on holding applicator, merely keeps the feed chute loaded with pieces to be lapped. Cylindrical pieces feed in between lapping rolls; are lapped to a precision finish of less than two micro inches as they move to the left under the holding vane; and are ejected at the opposite end.

Adjustable spring tension on the holding applicator determines pressure that will be applied to cylindrical pieces as they are lapped. As one of the four holding vanes becomes gummed up with lapping compound and other material, a clean vane can be immediately rotated into working position.

E-231—High-Speed Tapping Machines

The Cleveland Tapping Machine Co., Hartville, Ohio, offers its new Model E tapping machines in six sizes for tapping either right or left threads from $\frac{1}{4}$ in. to $2\frac{3}{4}$ in. In addition to single-hole tapping at high speeds, they are designed for use with multiple heads for tapping groups of holes, even of different sizes, with a single stroke of the spindle. Adjustable heads may be used where the pattern of the hole varies in production and indexing tables, cross slides and hopper feeds may be combined with automatic cycling of the machine to provide completely-automatic operation.

The heat-treated alloy-steel spindle mounted in Timken tapered roller bearings and the super-sensitive clutch, in combination with positive coolant control, are said to eliminate tap breakage and greatly increase tap life.



Fellows 36-in. gear shaper

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INLAND 4-WAY FLOOR PLATE



NEW Products

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F-163—Three-Speed Auxiliary Transmission

A new three-speed auxiliary transmission providing a full-torque power take-off in the transmission case has been released to production by the Fuller Manufacturing Co., Kalamazoo, Mich.

The new transmission, designated Model 3-T-92, is said to offer in a single unit, all of the advantages normally provided by the use of auxiliary transmissions with top-mounted power take-off. For rigidity and strength the power take-off gears and shaft are built directly into the transmission case where the section of the casting will permit the application of full engine torque.

The ratios available from the full torque power take-off vary with the direction of rotation of the shaft. When turning in the same direction as the input shaft of the auxiliary transmission, the ratio is 1.175 to 1. When rotation is in the opposite direction, the ratio is 1.345 to 1. The power take-off shaft has been set up so that power may be taken from projections at either the front or rear ends which are machined and keywayed to permit the use of flanges, sprockets, etc., bored to an inside diameter of $1\frac{1}{8}$ in. and keywayed for a $3/16$ in. by $\frac{1}{8}$ in. straight key.

For flexibility of operation, the full torque power take-off will provide both forward and reverse speeds. The range of speeds will depend directly upon the number of forward speeds available from the unit type transmission attached directly to the engine.

For motive power, Model 3-T-92 provides the same transmission gear ratios offered in Model 3-A-92 Fuller auxiliary transmission. The overdrive ratio is .754 to 1., direct is 1.00 to 1. and the reduction ratio is 2.09 to 1.

The input and output shafts for motive power are the same size as those in Model 3-A-92; both being equipped with the standard $2\frac{1}{4}$ in. ten spline. Both the front and rear ends of Model 3-T-92 are designed for cross member support. The auxiliary transmission drive is shifted with Fuller Model AC remote control. The power take-off drive is shifted with an independent lever.

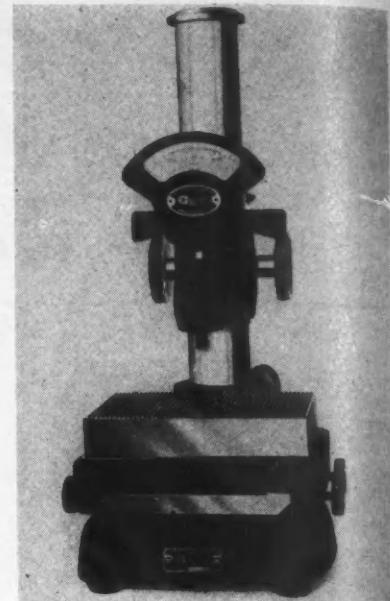
The weight of the newly introduced transmission without support members is 553 lb. With support members the weight is 608 lb.

F-164—Comparator Uses Standard Indicators

Provisions for five interchangeable tables and the use of standard indicators are features of the Model 108 comparator offered by Standard Gage Co., Poughkeepsie, N. Y. This comparator is therefore suited to production and inspection measuring jobs. When equipped with the Micronar indicator, it affords a means of checking plug gages.

Any AGD dial indicator of the No. 2 or No. 3 size having standard lug type back can be used. Thus, an indicator having graduations appropriate to the accuracy desired may be mounted on the comparator. With the Micronar indicator, measurements are said to be made to an accuracy usually associated only with more elaborate instruments.

Raising, lowering, and approximate positioning of the indicator support arm are facilitated by a rack on the rear of the column. Fine adjustment for setting the comparator to a standard is effected by a wing handle. Pressure of the contact point on the work piece can be regulated by means of a



Model 108 comparator made by Standard Gage Co.

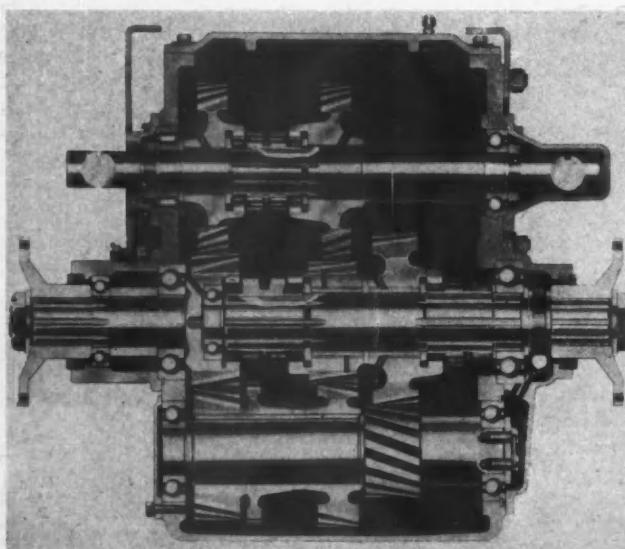
knurled bushing. A reed mechanism within the head prevents side thrust from reaching the indicator and thus adversely affecting accuracy.

F-165—Hard-Facing Alloy

Metallizing Engineering Co., Inc., Long Island City, N.Y., is introducing Metco-Weld H, a "wire" composed of a powdered hard-facing alloy extruded in a plastic binder, for use in a metallizing gun.

This Sprayweld method is said to attain the objective of applying smooth, uniform, relatively thin hard coatings, in a practical and inexpensive manner.

During the spraying operation, the plastic binder is completely volatilized, and the deposit consists entirely of the metallic constituent. Subsequent fusing, with any fusing torch or with an attachment on a Metco metallizing gun, results in a coating alloyed to the base and physically and chemically identical to hard-facings of the same alloy applied by other methods.



Model 3-T-92 Fuller auxiliary transmission

F-166—Strain Recorder

Newly added to its line by the Baldwin Locomotive Works, Philadelphia 42, Pa., is the Type M stress-strain recorder controlled by two Microformers (variable miniature transformers) which are built into strain follower and recorder mechanisms. Principal application is in recording strains or deformation in test specimens subjected to tension, compression or flexure in Baldwin and other Universal testing machines.

In operation, changing deformation in the specimen actuates the movable core of the strain-follower Microformer, which changes its output and unbalances an electrical circuit that includes the similar Microformer in the re-



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corder. The resulting electrical impulse is amplified to drive a servo motor, which moves the core of the recorder Microformer, thus rebalancing the electrical circuit, and rotates the recorder drum in proportion to specimen deformation. Corresponding values of applied load are recorded by movement of the stylus parallel to the axis of the recorder drum. The stylus is actuated mechanically by the testing machine load indicator.

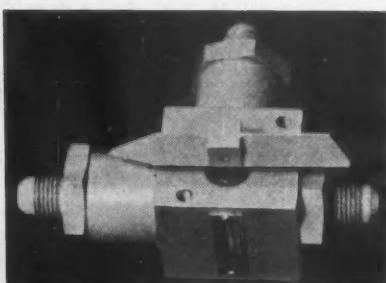
The direction of rotation of the recorder drum changes automatically with change in direction of deformation in the specimen. This facilitates the recording of tests in which specimens are loaded and unloaded. The performance of the Microformer-controlled strain-recording element of the recorder is reported to be consistently accurate over a wide range of testing speeds.

Although the Microformer system is being used chiefly with strain-recording devices designed to magnify strain up to 1000 times or more, it is also adaptable for recording almost any pair of variables by using some index of each variable to actuate a Microformer, the manufacturer states.

F-167—Fuel Tank Selector Valve

Electrol, Inc., 85 Grand St., Kingston, N. Y., has brought out a new positive-position and positive-sealing fuel tank selector valve. While developed primarily for precision control of aircraft fuel lines, this selector valve is said to have many industrial fuel supply applications. It is usable in air, water and oil, as well as in gasoline systems.

The Electrol fuel selector valve, designated as Model 544, assures positive positions of the control handle by means of built-in detents, features a poppet type valve that assures "free" operation and eliminates sticking, even over a long period of time, has low pressure drops and has connecting fittings that are integral with the unit.



Electrol selector valve, model 544

There are four handle positions — tank No. 1 "on," both tanks "on," tank No. 2 "on" and both tanks "off." The housing is made of aluminum alloy with anodized finish. Port sizes may be varied to suit the individual application.

F-168—Wiper Blade for Curved Windshields

A new wiper blade for curved windshields, the Trico "Rainbow," is announced by the Trico Products Corp. of Buffalo, N. Y.

With a "vertebrae" that flexes to conform to the contour of the glass, the "Rainbow" curves or flattens to main-



Trico Rainbow wiper blade

tain perfect wiping contact throughout its arc of travel as the shape of the contour changes.

A yoke-type connector applies pressure which is transmitted evenly throughout the entire length of the flexible blade. The blade's "backbone" prevents sidewise movement yet permits the blade to flex in and out. The live rubber wiping edge is resilient enough to tilt over slightly on its edge so as to present the correct wiping angle as it operates.

Coupled with the blade is Trico's new "wrist-action" connector which produces an improved reversing action at the end of each stroke and which also provides a more simple "lock-on" connection with the wiper arm.

F-169—Photographic Paper

A silver-sensitized paper for reproducing engineering drawings on blueprint or direct-process equipment has been introduced by the Eastman Kodak Co., Rochester 4, N. Y.

Known as Kodagraph Autopositive, the paper embodies a new type emulsion which permits its use in normal room light and produces a high-contrast positive copy directly from a positive original.

Such copies are intended primarily for use as printing intermediates or "masters" and are said to make possible quick and economical production of blueprints or diazos of exceptionally high quality and at uniformly high

rates of speed. They also are of value as file copies because of the long life of the photographic image.

Kodagraph Autopositive paper may also be used to eliminate redrafting of worn, discolored, or opaque engineering drawings. The new Kodak paper combines the fine detail obtained by contact printing with high contrast previously obtainable only through the use of the process camera and negative-positive steps. As a result, Kodagraph Autopositive paper makes possible the production of diazo or blueprints from drawings which in the past have generally been regarded as "unprintable."

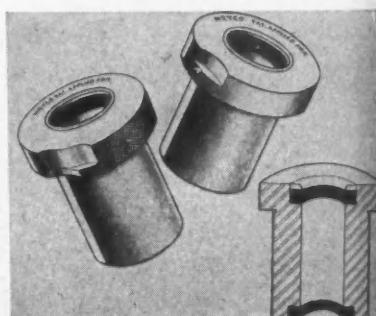
For the same reason, too, the new Kodak paper serves as an excellent medium for making printing intermediates or file copies where original drawings have been lost and only blueprints or diazos are available.

F-170—Synthetic Coating

A synthetic coating which can be built up to extra-heavy thicknesses is a recent development of United Chromium, Inc., 51 E. 42 St., New York 17, N. Y. Primarily designed to insulate and protect electroplating racks, it has possibilities for numerous other products. This material, known as Uni-chrome coating 218, contains 100 per cent solids, with nothing to evaporate. It is a baking synthetic, applied by dipping or spraying and when cured at 350 F. becomes a sleek, elastic coating. On some racks, thickness up to $\frac{1}{4}$ in. can be achieved within two hours on areas where such a degree of protection is desirable.

Coating 218 is said to withstand mechanical abuse without chipping, tearing or lifting from equipment to which it is applied, and also to withstand a variety of strong chemicals in addition to hot cleaning solutions and all plating solutions.

F-171—Carbide Inserted Drill Bushings



The above cut-away illustration shows the construction of a standard line of Meyco carbide-inserted drill jig bushings made by the W. F. Meyers Co., Bedford, Ind. The hardened steel ring inserted above the top carbide ring protects both the carbide and the drill against shock of impact. The bushings are made to the dimensional standards of the American Standards Association.

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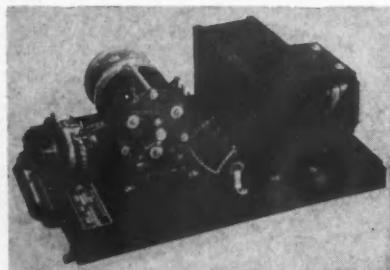
F-172—Heater and Heater Controls

To meet demands from operators of DC-3 airplanes for a more effective pilot's compartment and cabin heating system, the Surface Combustion Corp., Toledo 1, Ohio, is now offering one of its Janitrol combustion heaters of the same basic design as those regularly used on later types of commercial airplanes. The manufacturer states that by providing more than twice the heat output of the original system, the heater not only gives sufficient heat to cope with atmospheric temperatures down to -50 F but can maintain uniform heat output in flight regardless of engine operating conditions.

Sufficient heat is also available for windshield anti-icing under certain conditions. Improved ventilating is also possible since more warmed fresh air may be admitted with the new installation. By the use of an auxiliary blower, heat may be made available on the ground if desired.

In addition to the new heater, Surface Combustion has brought out two "Control Containers" to facilitate installation and to aid in standardizing maintenance procedures, as well as to minimize or eliminate any possible hazards from leakage or failure of fuel tubing, improper functioning of controls, etc. The containers enclose in a single sealed casing or "can" the controls necessary for the operation of the S-C heaters ranging in capacity from 100,000 Btu output to 300,000 Btu in-

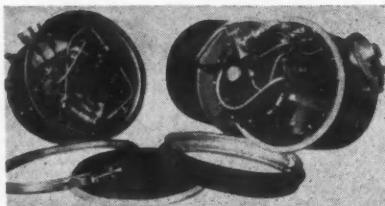
F-173—Voltage Regulator



This voltage regulator designed to provide controlled voltage for electrically heated aircraft windshields is available from Westinghouse Electric Corp., Pittsburgh, Pa. The assembly is designed to handle an 11 kva, 3 phase, 208/120 volt, 4000-8000 rpm alternator. It weighs 6.65 lb. The panel is arranged with a plug connector for ease of installation on a shock mount in the airplane, and all maintenance, testing and adjustment can be performed at the service bench.

clusive, and also may be applied to smaller units. Commercial installations to date include those on DC-4, DC-6 and some DC-3 airplanes.

Two sizes and types of containers are



Single and double fuel pressure regulator types of "Control Containers"

available. The smaller size incorporates within the casing a fuel filter, air-loaded fuel pressure regulator and magnetic fuel flow valve. Two fuel pressure regulators are included in the larger-sized container. Either size may be used with an electrically operated fuel pressure transmitter to provide a direct indication of the actual fuel nozzle pressure on the instrument panel of the airplane.

F-174—Engine Oil Conditioning Unit

Winslow Engineering Co. of Oakland, Calif., has developed a lubricating oil conditioning unit for aircraft engines. Three sizes are now available for engines up to 150 hp, using the Winslow free-flow element.

All Winslow oil conditioning units feature an element within the pressed steel case that gives progressively finer filtration of the oil as it passes from the outside of the element to the inner core. The entire surface of the element is available for filtering, and the replaceable elements are treated with a compound that neutralizes acids and removes water without affecting the detergents in compounded oils.

Installation approval from the CAA requires only that the units be used on engines with a maximum oil pressure of 65 lb, be installed as a shunt unit, and mounted to withstand vibration using flexible inlet and outlet lines.

F-175—Reclining Airline Seat

Greater passenger comfort and convenience are emphasized in a new CAA approved airline seat featuring a rugged table that locks in the arms rests, a back cushion that lowers to a 70-deg reclining position, a lightweight cushioned leg rest and a center arm rest that folds downward between the

cushions, according to the manufacturer, Hardman Manufacturing Co., Southgate, California.

Two metal supports permanently attached to the table are inserted in arm rest slots to assure rigidity and to give



Hardman airline seat

the passenger a steady surface on which to dine, write or play cards. These supports extend only to the inside edge of the arm rests so that when the table is in use the passenger can reach the eight-oz steel flush-type ash trays in the outer arm rests. When not being used, the table is stored in a pocket in the rear of the chair forward of the passenger.

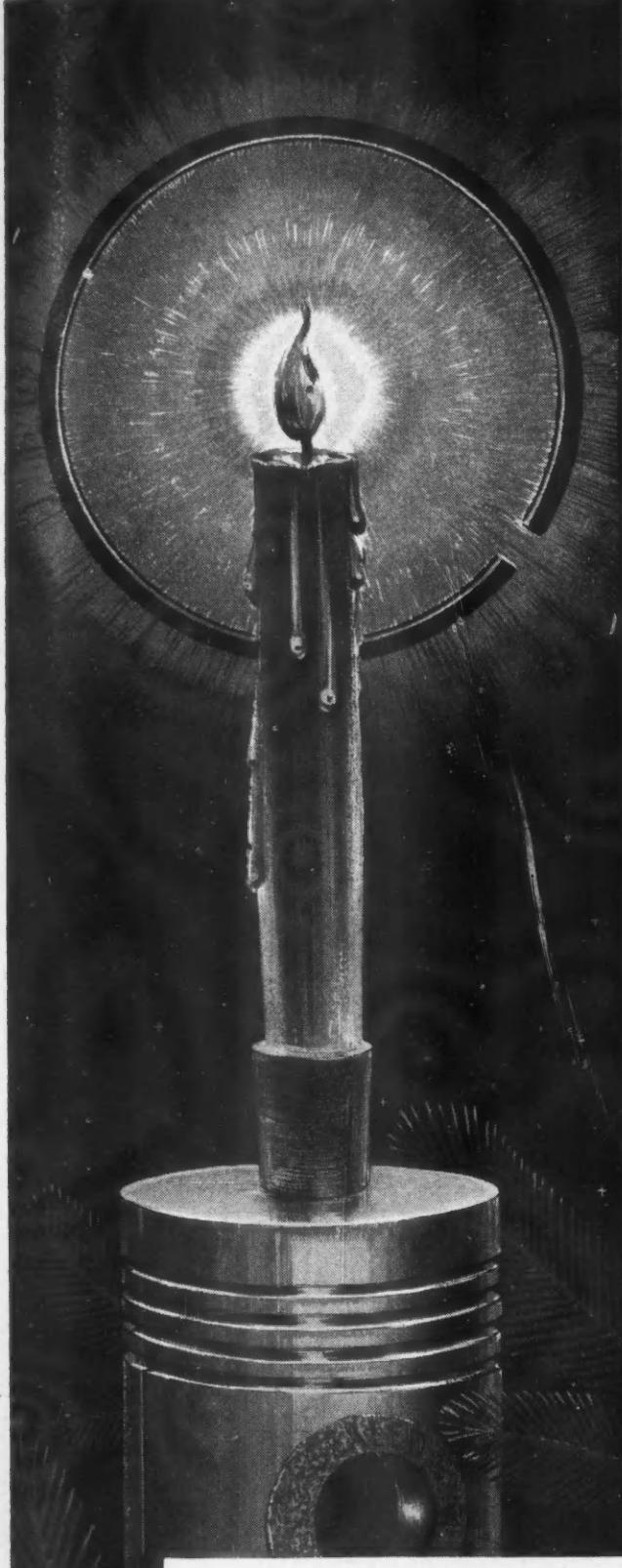
The leg rest and 70-deg reclining back cushion contribute materially to the passenger's comfort while he is sleeping or relaxing. (When chairs are spaced within 40 in. fore and aft, a limit stop in the seat will restrict the recline to 45 deg.) Recline is regulated by a button on a plastic panel on the outer arm rests.

Cushions of this new airliner seat are available in either foam rubber or springs, the manufacturer states. Built-in head rests on the back cushion are optional, either the "ear" type or the "pillow" type being provided.

F-176—Weight-Saving Direction Valve



This new weight-saving direction valve for releasing fire killing carbon dioxide in multi-engine planes is made by Walter Kidde & Company, Inc. of Belleville, N. J. This new valve replaces stop valves which were formerly used in directing the flow of carbon dioxide gas. It operates electrically by use of a solenoid and has a high rate of flow.



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**for 37 years
of co-operation**

Sealed Power was founded in 1911. At the threshold of 1948, we want to express our appreciation to the automotive engineers. Without their close co-operation since the beginning of Sealed Power, we could never have gained and held leadership in the piston ring field. Sealed Power factories, laboratory facilities, and staff are now at the highest peak of our history. You are invited to use them to help make your good engines even better.

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PUBLICATIONS AVAILABLE

Publications listed in this department are obtainable by subscribers through the Editorial Department of AUTOMOTIVE INDUSTRIES. In making requests please be sure to give the NUMBER of the item concerning the publication desired, your name and address, company connection and title.

D-140—Cutting Fluids

D. A. Stuart Oil Co., Ltd.—Cutting Fluids for Better Machining is the title of a 72-page (revised) catalog of metalworking information. It contains data on the application of Stuart oils for cutting, grinding, drawing, quenching and tempering and all other phases of metalworking and industrial lubrication. Useful sections on metal cutting mechanisms, the selection of cutting fluids, rules for prolonging tool life, handy tables of standard steel specifications, Independent Research Committee Data and Marking System Chart for grinding wheels are included.

D-141—Knockometers

Sperry Gyroscope Co., Inc.—Two new circulars describe Knockometers for automotive and aviation fuel testing on single cylinder laboratory engines. The literature describes the operation and the specifications of Knockometer models K-1 (aviation) and K-3 (automotive).

D-142—Hy-Draulic Slotters

Rockford Machine Tool Co.—A new, 20-page bulletin, No. 460, covers design, construction and applications of Rockford Hy-Draulic 36 and 48 inch Slotters. Dimensional diagrams which illustrate

the work range of these slotters is included in the bulletin, together with information provided in specification form as well as complete descriptions, of all the facts relating to slotter feeds and speeds.

D-143—DoALL Contour Saws

The DoALL Company — The 12th edition of DoALL Contour Saws has been revised and enlarged to include a new section on instruction programs for use in a shop or school training course. It describes through photographs, charts and drawings the techniques for contour sawing and filing, also high speed sawing and the friction cutting methods with band sawing equipment. Numerous applications are pictured and described.

D-144—Cemented Carbide Products

Carboloy Co., Inc.—Catalog GT-200 is a completely new 65-page general tool and carbide parts catalog covering the company's standard cemented carbide products, with specifications and prices. A 12-page section is devoted to wear resistance applications. The new method of attaching large sections of carbide with studs, bolts, etc., is pictorially de-

scribed. Other features of the catalog are small line sketches showing typical applications of standard carbide tools and suggested uses for various shapes of standard carbide blanks; a full page chart showing where to use the various grades of Carboloy cemented carbide.

D-145—Kodagraph Autopositive Paper

Eastman Kodak Co., Industrial Photographic Div.—An 8-page booklet describes a silver-sensitized paper for reproducing engineering drawings, includes information on the use of the paper for such problems as reproducing opaque drawings, worn, stained or discolored tracings, or direct process prints or blueprints.

D-146—Rubber and Synthetic Rubber Products

The H. O. Canfield Co.—A Technical Catalog, recently published, presents an extensive line of rubber products and component parts for which mold and die equipment is available. Complete data, specifications and measurements for the various parts are included in the catalog.

D-147—Stainless Electrodes

Arcos Corp. — A bulletin entitled What Electrode to Use to Weld a Specified Stainless or Alloy Steel, gives information on base metal identification of solid and clad materials, recommended types of electrodes, special considerations involving corrosion, heat or

(Turn to page 84, please)

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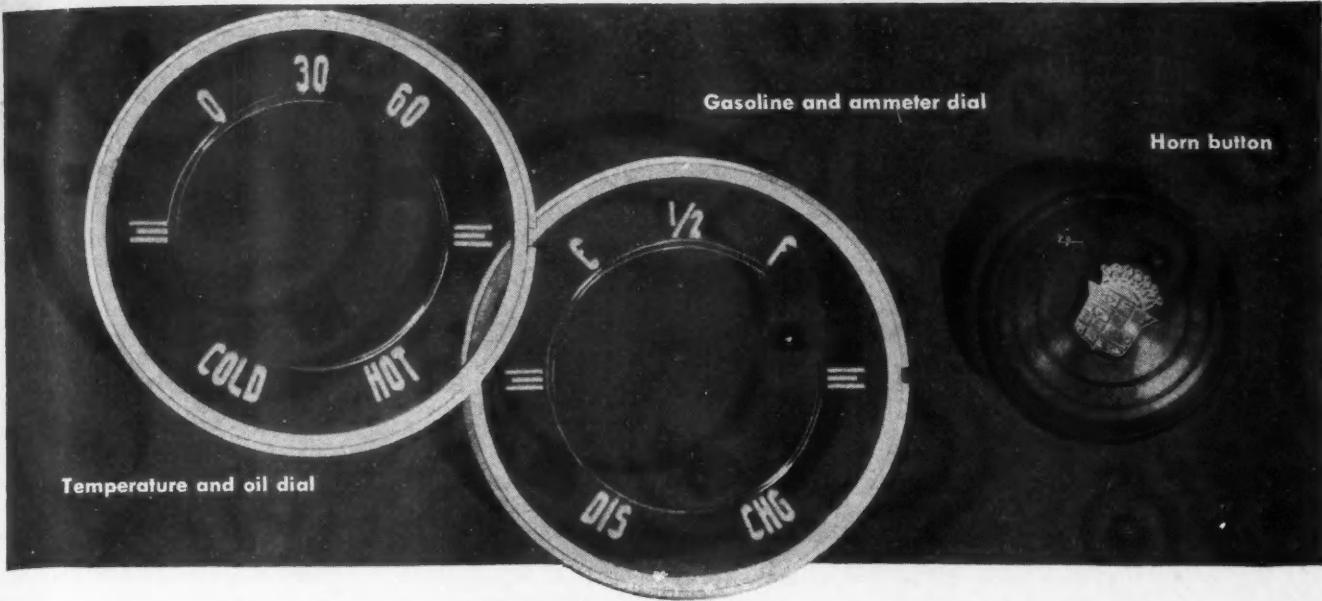
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Beauty AT WORK ... on another new car with Du Pont "LUCITE"

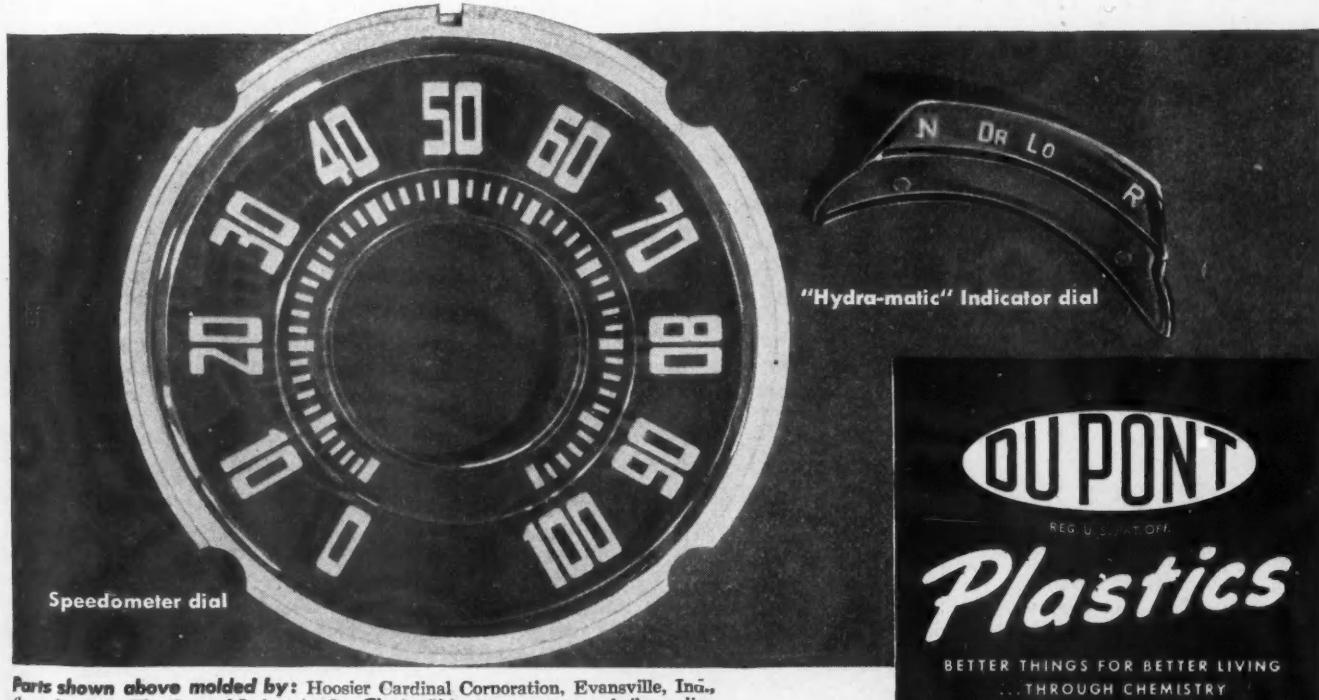
**On 15 different makes of new cars
there are 58 separate parts made of
Du Pont "Lucite"**

The parts shown here are on one of these new cars. Here is a practical kind of beauty—practical because the optical properties of "Lucite" and its ability to edge-light help provide the driver with instant answers to urgent questions concerning speed, fuel sup-

ply, temperature and other driving essentials.

And in addition, "Lucite" acrylic resin retains its beauty and its clarity for years. For "Lucite" resists moisture, sunlight, and weathering. It has high tensile and flexural strength.

Du Pont "Lucite" is available in your choice of colors or in colorless transparency. Write for booklet, "Heat-Resistant 'Lucite,'" E. I. du Pont de Nemours & Co. (Inc.), Plastics Dept., Room 2012, Arlington, N. J.



Parts shown above molded by: Hoosier Cardinal Corporation, Evansville, Ind.; (horn button); The General Industries Co., Elvria, Ohio, (temperature and oil, gasoline and ammeter and speedometer dials); Erie Resistor Corp., Erie, Pa., (indicator dials).

Philips Air Engine

(Continued from page 28)

transfer piston: a body situated between the hot and the cold spaces and occupying at least as much volume as the maximum of the hot or cold space. By moving this body to and fro periodically the air was made to flow back and forth between the hot and cold spaces. The transfer piston was not loaded, because the pressure in the cold space was, in principle, the same at every moment as that in the hot space. The cold space was shut off from the outside air by an ordinary piston. This single piston served both for the gain of work upon expansion and for the supply of work upon compression. Since there was no difference in pressure on either side of the transfer piston, it was not necessary for it to be made to fit tightly in the cylinder, so that there were no great frictional losses.

An arrangement of an engine with transfer piston is shown in Fig. 7. Here the cold space is not divided between two cylinders and, by a suitable choice of the lengths of the stroke and the mutual phase difference between working piston and transfer piston, both the hot and cold volumes can be made equal to zero once per revolution.

Single-Cycle Philips Air Engine

The most important details of the improved single-cycle Philips air engine can be seen in Fig. 8. The heater, regenerator and cooler, instead of being placed in a separate communication channel between the hot and cold spaces, are given an annular shape and placed around the cylinder. This produces a very compact arrangement while, at the same time with the absence of inlet channels, unnecessary flow resistance and dead volume are avoided. The heater, which is enclosed on the inside by a thin-walled cylinder of heat-resisting metal, opens directly into the hot space. The heater is heated externally by means of a burner. The cold space is in communication with the cooler via a ring of ports in its wall.

The lower part of the transfer piston is provided with a bearing surface while the upper part in the hot space consists of a thin-walled cap leaving some clearance in the cylinder. This cap, which is made of heat-resisting material with low heat conductivity (nickel-chromium steel), fulfills an important function. This thin, poorly conductive wall of the cap insures that only very little heat flows through it from the hot top end to the cold bottom end. Furthermore, there is only a minimum transfer of heat through the thin layer of gas in the annular space between the cap and the cylinder wall. Thus, any loss of heat that might in principle be due to the trans-

fer piston is limited. Still more important, however, is the fact that the insulating action of the cap keeps the bearing surface of the transfer piston cool. This avoids all the difficulties of tight-sealing and wear which are encountered with hot sliding surfaces.

The engine is provided with a closed crankcase. The air in the crankcase is kept at the desired pressure by means of a small pump C, Fig. 8, which pumps air from the outside into the crankcase and is driven by the engine itself. Through the open connection at the lowest position of the piston, the minimum pressure of the cycle is automatically made equal to the crankcase pressure. Therefore, by adjusting the crankcase pressure with the help of the pump, the pressure and thus the power of the engine can be regulated in a very simple way.

The elevated pressure in the crankcase offers an advantage with respect to the mechanical efficiency of the engine. Owing to the fact that the alternating difference in pressure on either side of the piston is lowered by a constant amount, the forces of the piston rod that have to be transmitted to the crankshaft are reduced accordingly. Thus, there is a lighter load on the bearings, and the frictional losses are less. A photograph of this single cycle engine is shown in Fig. 9. A large number of test measurements show that the efficiency of this type of engine is quite satisfactory, many times better than that of previous air engines. This type is suitable for a rating of several hp and not too high speeds (e.g. up to 2000 rpm). The limited speed is due to the fact that, as in the case of the primitive model in Fig. 5 and in all kinds of single-cylinder engines, the engine cannot be balanced in a simple manner. The need for a proper balancing and higher powers introduces the multiple engines.

Multiple Engines

In multiple or multi-cylinder engines the air engine construction can be greatly simplified. This simplification lies in the manner in which several systems are combined to form a multiple engine. In Fig. 10 the principle is illustrated for the case of a four-cylinder engine. In each of the four cylinders there is a hot space (above) and a cold space (below). Contrary to what might be expected, however, the hot and cold spaces in each cylinder do not form a coordinated system, for the hot space of one cylinder is connected via a heater, regenerator and cooler with the cold space of the next cylinder. Such an arrangement could be compared, for instance, to that of Fig. 6, for in both cases it can be seen that upon expan-

sion of the working medium the two pistons between which the system is situated will deliver more work to the engine shaft than that which they have to perform for compression of the working medium within the system, provided the volume variations of the hot space (in the first cylinder) are advanced in phase with respect to the variations in the cold space (in the second cylinder) according to the conditions already given. It can be seen that this is obtained when the piston of the second cylinder is in advance of that of the first—a condition that can be satisfied in a very natural way since in a multi-cylinder engine the series of pistons will never be made to move in a phase. What has been stated here for one pair of pistons and the system between them also holds for the rest. If, therefore, each of the four pistons in Fig. 10 is made to move in advance of the preceding one, each of the four systems works as an air engine. With this simple combination of the systems, the transfer pistons with their driving mechanism are dispensed with.

As to the phase differences of the pistons, it is obvious that with four pistons there should be a phase shift of 90 deg in their motions. The volume variations of corresponding hot and cold spaces then likewise differ 90 deg in phase. Combinations can also be made with more than four systems, of course, with different phase differences. Within certain limits this has little effect upon the efficiency of the engine, since the curve representing the efficiency of the hot-air process as a function of the phase difference between the hot and cold spaces is fairly flat in the neighborhood of the maximum.

With the method of communication between the hot and cold spaces as shown in Fig. 10 each piston must be in advance of the preceding one. This order of piston movements determines the direction of rotation of the engine. If the connections between the cylinders are interchanged, each hot space being connected with the cold space of the preceding cylinder (in Fig. 10 this has been indicated diagrammatically for one cylinder by dotted lines), each system again works as an air engine, provided the order of the piston motions is reversed. This means that the engine then runs in the opposite direction. This provides a very simple method of reversing the direction of rotation of the engine while it is running. The reversal of the connections between the cylinders is brought about with the aid of a slide for each cylinder, which can be fitted on the cold side of the engine.

It is also of importance that in a multi-cylinder engine each piston is
(Turn to page 60, please)

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TRIES

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Spark Arrester Inside Muffler

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REYNOLDS, WIRE CO.
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Philips Engine

(Continued from page 58)

double-acting. In Fig. 8, as in all the engines so far dealt with, the piston is single-acting because it transmits energy from the work medium to the crankshaft only during the down stroke, while on the up stroke work is performed on the working medium. The former work is larger than the latter, the difference being the mechanical energy gain. But the frictional losses bear a definite relation to the total energy conversion in the driving me-

chanism, no matter whether the various energy contributions count in a positive or a negative sense for the consumer. However, in Fig. 10 each piston transmits energy from the working medium to the engine shaft both on its down stroke and on its up stroke, for each piston is situated between two systems. The upward stroke of the piston coincides for a large part with the expansion of the left-hand system and with the compression of the right-hand system; conversely the down stroke is for the greater part simultaneous with the expansion of the right-hand and the compression of the left hand system. In both cases, therefore, the

compression in one system is brought about for a large part directly by the expanding medium in the neighboring system, only via the body of the piston; the driving mechanism takes no part in this, only transmitting the excess of work furnished by each expansion. The energy conversion in the driving mechanism is therefore no greater than that which corresponds to the power of the engine. Consequently, the frictional losses are also limited.

Owing to the relatively small forces in the connecting rods, the multi-cylinder air engine compares favorably with an internal combustion engine of the same power per cylinder, the same swept volume and the same speed. In an air engine of five hp per cylinder and a speed of 3000 rpm, the peak value of the resulting force in the connecting rod is about 550 lb. In a comparable internal combustion engine, on the other hand, there is a maximum force in the connecting rod of about 2650 lb. These smaller connecting rod forces in the air engine mean less load on the bearings, a factor of great importance for the construction.

As to the practical construction of the multi-cylinder engine, it has been possible to apply practically unaltered many of the structural elements described in connection with the single-cylinder engine, such as the annular-shaped heater, regenerator and cooler around each cylinder and the insulation caps on the pistons serving to keep the running surfaces cool. A new problem, however, is the arrangement of the position of the various cylinders and the transmission of all the piston forces to one shaft.

The cylinders preferably are arranged so that all the cold spaces lie on one side of the engine with all the driving mechanism. Such an arrangement has already been assumed in the diagram of Fig. 10. In that diagram the four cylinders are in a row. This arrangement has the objection that a long connecting channel is necessary between the last and the first cylinder, which involves losses. In order to avoid this, the four cylinders can be placed in star formation, as is customary in aircraft engines (the cold side is then in the center of the star) or in two V's one behind the other, as is done in some automobile engines. Another possibility is to place the four cylinders parallel to each other and in a square. Whereas, with the first two arrangements a crankshaft construction can be used for converting the linear motion of the pistons into the rotating motion of the engine shaft, in the last case mentioned a wobble-plate mechanism is indicated. The practical model of the Philips multi-cylinder air engine illustrated in Fig. 12 is constructed in the last manner, but this design is considered only suitable for air engines of some 20-30 hp. For higher powers other driving mechanisms have been worked out, based on the arrangement of the cylinders in two V's, one behind the other.

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Windshield Washers
Fully Automatic; Nothing to Pump

Precision Castings

(Continued from page 40)

satisfactory in the production of turbine blades and very small steel alloy castings.

Permanent Molds

Permanent mold castings have an advantage over the lost wax process inasmuch as they require only one casting mold. Therefore, it is reasonable to believe that duplicate parts produced

by permanent molds would be more accurate.

One of the major inaccuracies of permanent mold castings is due to the application of the mold wash that is necessary to form a parting between the mold cavity and the molten metal. In making the mold cavity there is allowance made for the thickness of the wash; however, if the operator becomes lax, he is apt to build up this thickness,

thereby decreasing the size of the casting. The usual wash applied is approximately 0.005 to 0.010 in. thick, depending upon the size and shape of the part desired.

The physical properties obtained by permanent mold casting are far greater than those obtained by the sand casting or Antioch processes. It is essential to use the permanent mold process for parts to receive a high polish because the quick solidification obtained by this process drives the gas porosity to the center of the casting wall, and will allow polishing similar to a forging.

Hydraulic fittings where pressure tightness is required should definitely be made by this process. Wherever possible, the die should be such that metal cores could be used rather than sand cores, insuring a greater degree of density in the grain structure to reduce the possibility of leaks.

Die Casting

High precision at a very low production cost can be obtained by the die casting process. However, initial tooling cost is very high due to the fact that the cavities must be sunk into a die steel, which entails a great deal of highly skilled labor. Thought should be given to those dimensions of the part that are apt to lock into the die due to the shrinkage of the metal. The die incorporates ejection pins designed to overcome this locking. However, the grain structure of the metal will be slightly torn due to this restriction, and will, therefore, alter its shape if any machine cuts are taken to relieve the strain. There would also be evidence of distortion after heat treatment of the alloy.

Gating plays an important part in dimensional tolerances in die casting and if the part is quite intricate it would be very advisable to have the die caster submit a mockup previous to the making of the die. In this way it is possible for the engineer and die caster to coordinate their problems and, if necessary, redesign the part, possibly eliminating many of the problems in diecasting.

Die castings in aluminum have very minor surface defects due to aluminum oxide. Therefore, the designer should be wary of designing a part as a die casting that requires a highly polished surface. A zinc base alloy such as Zamac can produce a very satisfactory surface that will lend itself to a high polish, but it has to be a plated finish. Die casting of alloys such as magnesium, aluminum and zinc base alloys are highly satisfactory from a die-life standpoint, but alloys of a higher melting temperature will be unsatisfactory. Good physical properties can be obtained by die casting in the natural cast state, and most requirements can be satisfied without the necessity of heat treatment. This reference to heat treatment applies to magnesium and aluminum only.

(Turn to page 64, please)

a name identified with
good MOTOR performance

Lamb Electric

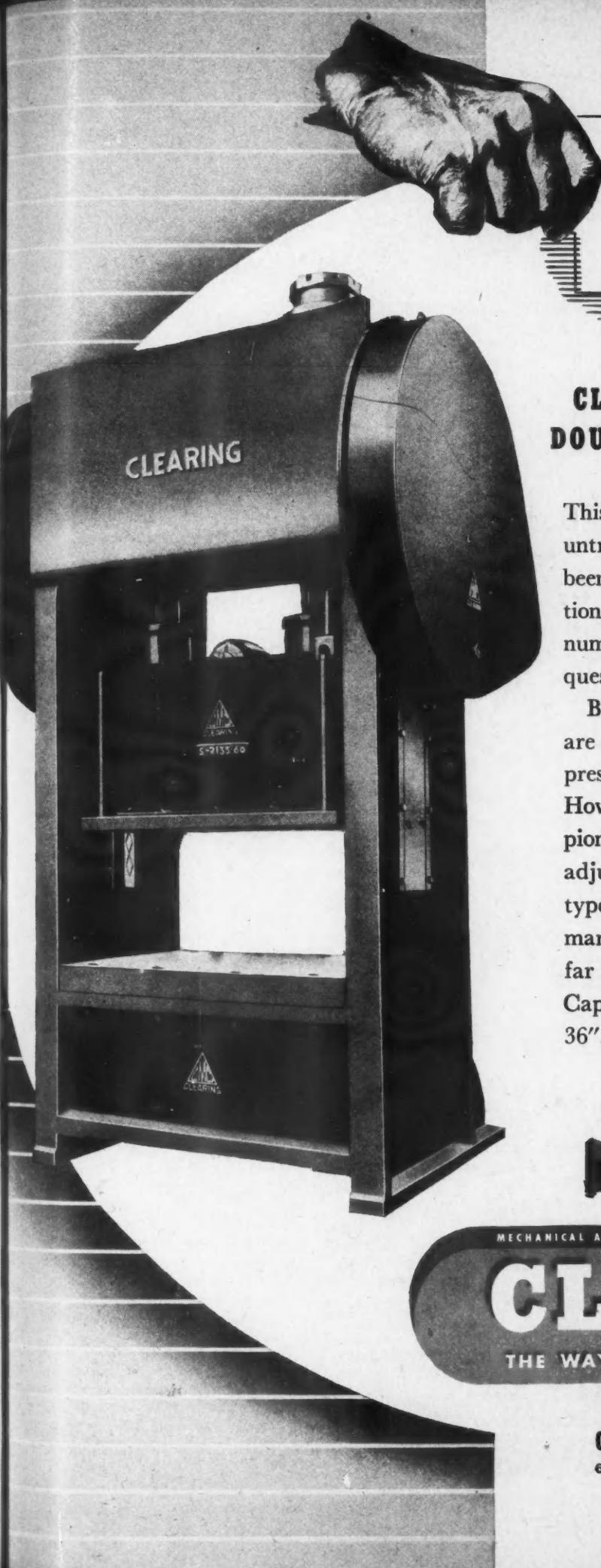
Specially designed for each particular application and with quality and dependability built into every part, Lamb Electric Motors have established a reputation for long, trouble-free performance.

Contributing importantly to this good performance is our experience gained in 31 years of designing and building small motors for over three thousand special applications.

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SPECIAL APPLICATION
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**CLEARING S SERIES PRESSES
DOUBLE CRANK—WELDED STEEL**

This Clearing series is new, but by no means untried. Clearing presses of S Series have been performing, in actual routine production, in different plants and in sufficient numbers to prove their merits beyond question.

Being crankshaft driven, these presses are naturally less costly than the eccentric presses for which Clearing is so well known. However, the welded steel construction—pioneered by Clearing years ago—the long, adjustable and removable gibs, the barrel-type slide adjustment, and other features mark the Clearing S Series, as something far beyond the ordinary crankshaft press. Capacities from 60 tons, bed widths from 36". Details are yours for the asking.



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THE WAY TO EFFICIENT MASS PRODUCTION

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6499 WEST 65TH STREET • CHICAGO 38, ILLINOIS



Precision Castings

(Continued from page 62)

Centrifugal Molded Casting

Centrifugal molded castings will yield high physical properties, and be free from the general flaws that are characteristic of gravity poured castings. This is due to the fact that the centrifugal force will actually pack the dross inclusions and force out the air, making the end result similar to a forging. In most cases the lost wax

investment process is actually cast centrifugally; however, larger castings are generally gravity poured. Precision-wise, the centrifugal casting is just as accurate as any other method, but the accuracy depends on the method of forming the cavity that receives the metal. If synthetic bonded baked core sand is used, the accuracy of the finished part depends on the equipment used in obtaining the shape previous to casting. Castings can be made centrifugally in permanent molds and will have the same high degree of accuracy that gravity poured castings will have. However, in the case of centrifugal poured permanent mold castings, the

physical properties obtained are tremendously higher than those obtained by any other casting method.

Vacuum Poured Castings

This new and novel means of pouring a casting is still in its infancy. The Osbrink Manufacturing Co. intends to conduct experiments along this line with the hope of eventually producing castings free from all minor defects. It has been possible to produce castings with unbelievably thin cross sections through this method of pouring. This technique would be valuable for magnesium as it would definitely reduce the possibility of isolated burning in gravity poured magnesium castings.

A large portion of inaccuracies in casting is due to the variable of shock that is produced by the fluctuation of pouring pressures. This is eliminated in vacuum poured castings because of the high degree of control which permits the foundry to reduce the pouring temperatures considerably.

when brake lining
problems confront
you

... consult GRIZZLY

REG. U. S. PAT. OFF.

For over thirty years, leading production, engineering and purchasing men have relied on Grizzly to provide fast, practical solutions to countless brake lining problems. Constant laboratory research, alertness to new developments and invaluable experience gained in over

thirty years' manufacturing experience, place Grizzly in an excellent position to solve brake lining problems of widely divergent natures.

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GRIZZLY MANUFACTURING COMPANY

PAULDING, OHIO

PLANTS AT PAULDING AND BELL, CALIF.

Warehouse Stocks in Principal Cities

Geneva Agreement

(Continued from page 45)

4. "Actual" values must be used in assessing ad valorem duties. A suitable definition for "actual" value for customs purposes is also set out.

5. Nondiscriminating treatment in the application of requirements for the marking of imported products to indicate their origin is also included.

6. With very rigidly defined exceptions, the use of quotas is prohibited.

7. Balance-of-payments restrictions maintained at the time the general agreement comes into force must be gradually relaxed as the countries reserve position improves and must be completely eliminated when the reserved position would no longer justify their maintenance.

8. The principle of nondiscrimination treatment is also extended to quantitative restrictions. It is required, first, that any restrictions applying to imports from or exports to any party to the agreement, must also apply to imports from, or exports to, all other countries. Second, whenever restrictions are applied they should preferably take the form of published quotas, specifying the amount or value of the particular products involved which will be permitted to be imported during a specified future. Certain necessary exceptions are included.

9. Countries may not circumvent the rules regarding quantitative restrictions by resorting to exchange controls having the same effect on trade.

10. State trading must be conducted on a nondiscriminatory basis.

11. Tariff concessions may be modified after Jan. 1, 1951, by obtaining the agreement of the country with which the concession was initially negotiated.

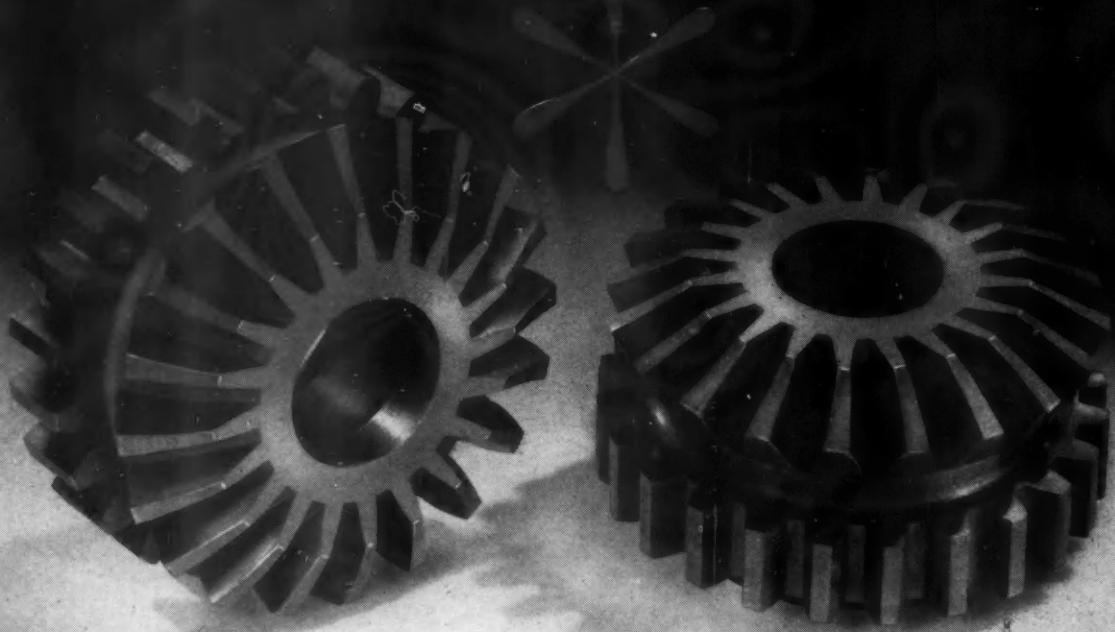


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* Can One gear do the work of Two?

IN THIS CASE, the answer was an emphatic "Yes!"

Although two gears could do the work and do it well, an integral spur and bevel does it better.

This design, shown in two views above, trims costs, simplifies assembly, increases strength and rigidity, reduces noise, and does an all-around better job.

PERHAPS your gear problem can benefit by engineering foresight and imagination of this kind. Perhaps *your* product, whatever it may be, will benefit by the unvarying standards of gear manufacture adopted more than twenty-five years ago and zealously followed ever since. Perhaps *your* customer—the man for whom both of us are working—will enjoy an added measure of

satisfaction because, somewhere in your product, Double Diamond Gears are doing so well the work they were carefully designed and built to do.

Aren't these possibilities worth considering? If you agree, Double Diamond engineers can get to work at once—either on your own specifications or on ones prepared by us to meet the standards you require. A letter is all that's necessary to get the project started.

Made by
Automotive Gear Works, Inc.
RICHMOND, INDIANA



FOR AUTOMOTIVE,
FARM EQUIPMENT AND
GENERAL INDUSTRIAL
APPLICATIONS



You get **EASY WORKABILITY...**
BETTER PERFORMANCE...

Plus a **2-WAY SAVING**

**when you use INCO NICKEL ALLOYS
in these forms**



You've probably often wished you could afford to use a quality metal in your product.

Now you can get an INCO Nickel Alloy, in some of the widely used forms, at a price that will make little or no change in your present per-unit costs.

And, that's only *half* the economy story.

Many manufacturers have eliminated the cost of one or more finishing operations . . . extra handling, special anneals.

For, these smooth, white alloys are *solid*, corrosion-resistant. They are hard and strong—stronger than mild steel. Their high ductility makes them easy to work and form. Use them wherever high temperatures are a problem.

Those are the reasons why manufacturers of choke tubes, ignition cable and automotive distributors found that an INCO Nickel Alloy provided a practical way to improve their products.

What metal problem is on your mind right now? You can either write us about it or call one of the distributors of INCO products listed at the right.

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67 Wall Street, New York 5, N. Y.

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DISTRIBUTED BY:**

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Current Automotive Patents Issued

Automobile Air-Conditioning Apparatus. Edward L. Hart, Phila., Pa., assignor to Philco Corp., Phila., Pa. (2,430,335).

Jet Augmenter for Combustion Turbine Propulsion Plants. Fritz Albert Max Heppner, Leamington Spa, England, assignor to Armstrong Siddeley Motors Ltd., Coventry, England. (2,430,399).

Hydrodynamic Brake. Lawrence R. Buckendale, Detroit, Mich., assignor to The Timken-Detroit Axle Co., Detroit, Mich. (2,429,889).

Pitch Control for Rotor Blades. Harold Hirsch, Buffalo, N. Y., assignor to Curtiss-Wright Corp. (2,430,767).

Two-Stroke Cycle Internal-Combustion Engine. Wilfred Percival Mansfield and John White, Slough, England, assignors to Michel Kadenacy, Summit, N. J. (2,431,266).

Submerged System of Jet Propulsion for Flying Boats. Frank J. Malina and Martin Summerfield, Pasadena, Calif., assignors to Aerojet Engineering Corp., Azusa, Calif. (2,431,132).

Planetary Transmission with Fluid Clutch. William D. Tipton, Stoneleigh, Md., Elizabeth Barrett Tipton executrix of said William D. Tipton, deceased. (2,430,089).

Gear Shifting Mechanism for Motor Vehicles. Philippe Grant, Overbrooke, Ontario, Canada. (2,430,169).

Hydraulic Transmission for Automobiles. Francis O. Jordan, Grosse Point Farms, Mich. (2,430,614).

Continuous Fuel Injection for Internal Combustion Engine. Francis J. Wiegand, Ridgewood, William T. Stark, Paterson, and Mark Robert Rowe, Teaneck, N. J., assignors to Wright Aeronautical Corp. (2,430,264).

Fluid Pressure Control System for Aircraft. Wilfred A. Eaton, Elyria, Ohio, assignor to Bendix-Westinghouse Automotive Air Brake Co., Elyria, Ohio. (2,430,808).

Hot-Spot Manifold. Stanley M. Udale, Detroit, Mich., assignor to George M. Holley and Earl Holley. (2,430,693).

Control for Hydraulic Brake Fluid. Steve Schnell, Kirkwood, Mo., assignor to Wagner Electric Corp., St. Louis, Mo. (2,439,955).

Air-Conditioning System for Motor Vehicles. George W. Crise, Columbus, Ohio. (2,430,759).

Safety Release Clutch. Rush G. Brown, Riverton, Wyo. (2,431,107).

Hydraulic Power Lift for Tractor Apparatus. Frank W. Wells and Joseph T. Kulhavy, Rock Island, Ill. (2,430,197).

Engine Governor. Marion Mallory, Detroit, Mich. (2,431,182).

Fuel Injection Apparatus. Albert T. Bremser, Sidney, N. Y., assignor to Bendix Aviation Corp., New York, N. Y. (2,430,801).

Transmission Control. Robert B. Aspinwall, Detroit, Mich., assignor to The Monopower Corp., Detroit, Mich. (2,430,799).

Turbo Planetary Transmission. Frampton E. Ellis, Jr., U. S. Navy (2,431,318).

Diesel Engine Starting Fluid. R. Wayne Goodale, Berkeley, Calif., assignor, by mesne assignments, to California Research Corp., San Francisco, Calif. (2,431,322).

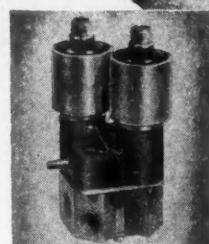
Aircraft Fuel System. David Samiran, Osborn, Ohio. (2,431,345).

Variable-Speed Transmission. Robert D. Morse, Monroe, Mich. (2,431,494).

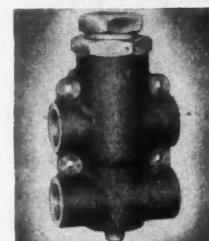
Engine Controller. Allan M. Starr, Piedmont, Calif., assignor to Starr and Sweetland. (2,431,516).

Turbine Blade. Arthur Gaudenzi, Wettigen, Switzerland, assignor to Aktiengesellschaft Brown, Boveri, & Cie, Baden, Switzerland. (2,431,660).

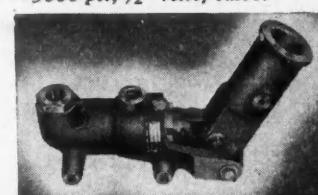
The foregoing patents were compiled from latest issues of the OFFICIAL GAZETTE of the U. S. Patent Office. Copies of the individual patents may be obtained from the Commissioner of Patents, Washington, D. C. at a cost of 25 cents each. The number of each patent is given in parenthesis.



Selector Valve, No. 16476—
3000 psi, Solenoid-Operated
with manual over-ride.



Relief Valve, No. 12108—
3000 psi, 1/2" relief valve.



Hand Pump, No. 12044—3000
psi, double acting hand pump.

General catalog is available upon letter-head request. Please address inquiries to 10747 Van Owen Street, Burbank, California.



ADEL PRECISION PRODUCTS CORP.

BURBANK, CALIFORNIA ★ HUNTINGTON, WEST VIRGINIA

Manufacturers of: Aircraft Hydraulic Systems • Aircraft Valves • Line Supports
Clips & Blocks • Halfco Self-Aligning Bearings • Marine & Industrial ISOHydraulic
Remote Controls • Industrial Hydraulic Equipment • Industrial Valves.

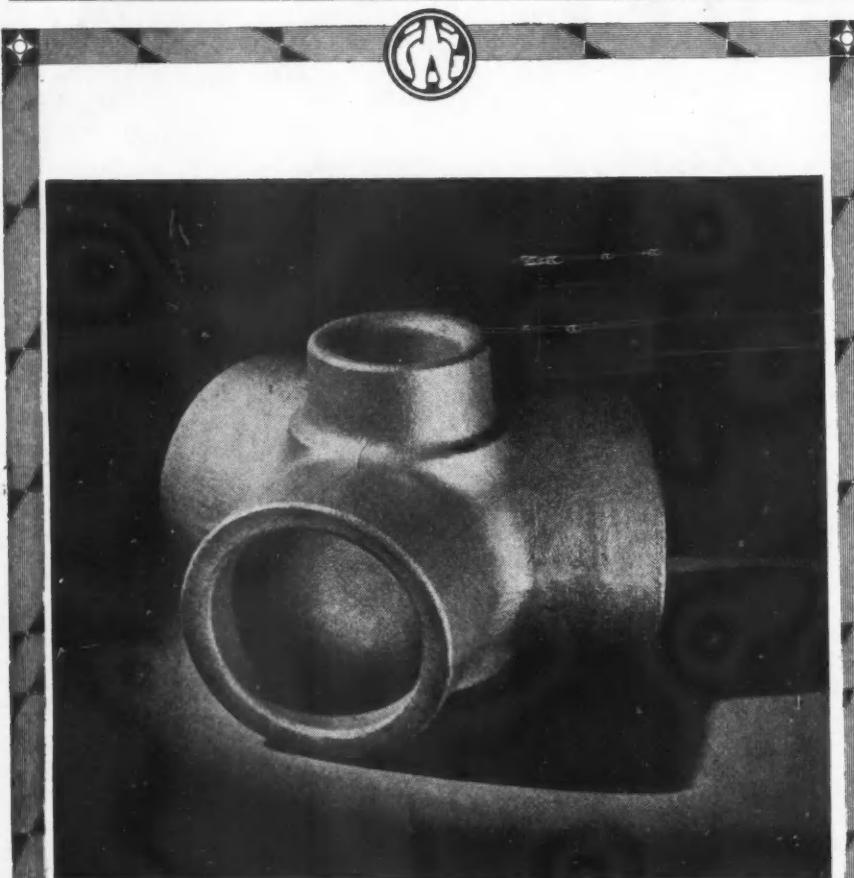
Observations

By Joseph Geschelin

Deep Draw

WITH the growing use of aluminum strip and sheet in motor car construction there is considerable interest in its deep drawing properties. We are assured that aluminum can be drawn into forms required in motor car applications. In certain

cases it is even possible to use the same dies as for the steel parts. Some modification in practice is required, for the most part in the use of special drawing compounds more suited to aluminum. However, for deep drawing aluminum requires "soft" sheet or strip, the quality being best determined by an applications engineer. It is important to realize that aluminum unlike steel "flows" rather than "stretches" when



Just a forging, but—the forging process develops the greatest combination of physical properties (tensile and compressive strength, ductility, impact and fatigue strength) and the greatest uniformity of quality of any method of manufacturing metallic shapes. . . . Wyman-Gordon has pioneered in the development of intricate forgings typical of which is the one-piece propeller hub illustrated here.

Standard of the Industry for Sixty Years

WYMAN-GORDON
Forgings of Aluminum, Magnesium, Steel
WORCESTER, MASSACHUSETTS, U. S. A.
HARVEY, ILLINOIS - DETROIT, MICHIGAN

drawn. Consequently, blankholder pressure is less for aluminum to permit the metal to move into the die so as to "flow" freely.

Transfer Machines

V

You can add The Cross Company, makers of special machinery, to the growing list of producers of transfer equipment. Their latest contribution is a noteworthy horizontal machine for machining the ends of rear axle housings. Productivity is of the order of 150 housings per hour with one man loading, another unloading and feeding the next operation. Ex-Cell-O has developed an outstanding line for cylinder blocks ready for announcement within the next month or so. We hear too that Kearney & Trecker will have an interesting transfer type milling machine line some time in the near future.

Clad Steel

J

UST as visualized before the war there is a growing use of clad steel in motor car construction. Several manufacturers are reported to have adopted stainless steel-clad strip for bumper bars. And alclad steel strip is being used in the fabrication of some mufflers for heavy duty truck applications.

Materials Handling

O

NE of the major advances in materials handling management is the palletizing technique. The principle is not new but its general adoption in industry is noteworthy. Palletizing is broad in application and is just as effective in an operation of moderate activity such as truck and tractor building as it is in a mass production plant like Ford or Chevrolet.

Permanent Mold Wheels

W

E HAVE it on good authority that the Dayton Steel Foundry Co., producers of cast steel wheels for heavy duty vehicles, are completing experimental production of a cast aluminum wheel of the same design by the permanent mold technique. This is quite an accomplishment considering the size of the product. Among the natural advantages of aluminum wheels are their lightness compared with steel and the economy of operation resulting from increasing the useful payload of a heavy duty truck.

FACTORS IN CHOOSING RESILIENT GASKETS

FACTORS IN CHOOSING RESILIENT GASKETS

Once a good flange or joint design has been developed, remains the problem of choosing a specific gasket material. Several factors can help narrow it down.

TEMPERATURE. Temperatures in excess of 250° F. eliminate most resilient gasketing materials. Where temperatures fluctuate, an average figure may be used as the upper limit. Surges to temperatures in excess of 250° ordinarily are not fatal if infrequent and of short duration.

If internal pressures are high, a tough, resilient gasket normally should be used in a tight groove or flange.

TORS IN CHOOSING RESILIENT GASKETS

nce a good flange or joint design has been developed, the problem of choosing a specific gasket material and its physical factors can help narrow the choice.

TEMPERATURE. Temperatures in excess of 250° F. eliminate most resilient gasketing materials. Where temperatures fluctuate, an average figure may be used. Where temperatures fluctuate, temperatures in excess of 250° ordinarily are not fatal if infrequent and of short duration.

INTERNAL PRESSURE. When internal pressures are high, a tough, resilient material should be used. Gaskets normally should be seated in a metal groove or flange.

FACTORS RESULTE

RESISTE

IN addition to being resilient, other sealing materials are available.

DESIGNING

The simple
and the
To realize
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economic use
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FIGURE 1

FIGURE 2

FIGURE 3

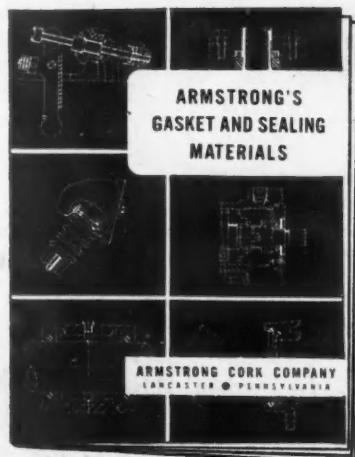
12

FACTORS IN CHOOSING RESILIENT GASKETS

IN addition to a review of the principal factors in choosing resilient gaskets, you will find design information on many other sealing problems in "Armstrong's Gasket and Sealing Materials." This new, 20-page booklet will prove helpful to purchasing agents as well as to designers and engineers.

As you know, many variables influence the design of gaskets and gasketed joints. Ten technical discussions in "Armstrong's Gasket and Sealing Materials" cover most of these variables. This booklet also contains physical data on the five major types of sealing materials offered by Armstrong: synthetic rubber compounds, cork-and-synthetic-rubber compositions, cork compositions, fiber sheet packings, and rag felt paper.

Add "Armstrong's Gasket and Sealing Materials" to your files now. Write today for your copy. Address Armstrong Cork Company, Gaskets and Packings Department, 1512 Arch St., Lancaster, Pennsylvania.



PARTIAL CONTENTS

Designing Flanges for Efficient Sealing, Designing Gaskets to Reduce Cost, Effect of Gasket Width on Compression, Effect of Surface Condition on Gaskets, Proper Compression for Resilient Gaskets, Relation of Gasket Thickness to Load, Resistance to Chemicals, and other useful material.

ARMSTRONG'S GASKETS • PACKINGS • SEALS

Different Hudsons for '48

(Continued from page 35)

of framing with eight cross members joined to four longitudinal members. The outside rails are carried at the lower edges of the side panels, actually enclosing the rear wheels. Vertical members extend upward from the outside rails to the roof; the body and roof panels being welded directly to these structural members. Noteworthy feature of the body is the fact that the

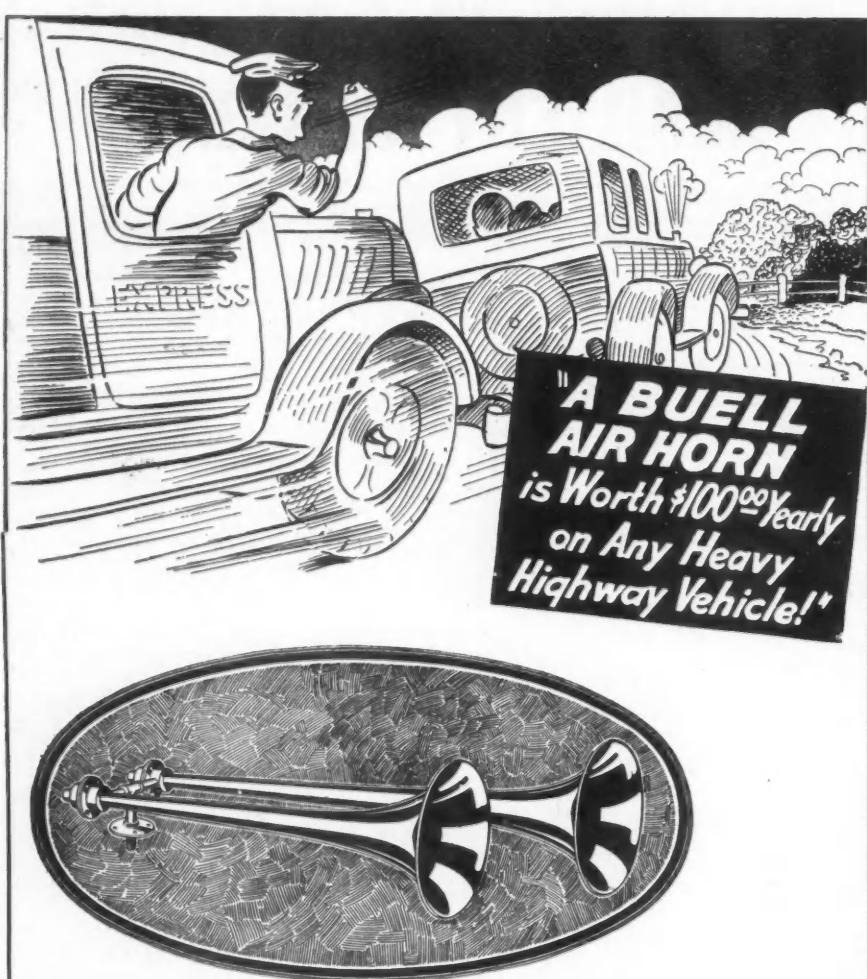
entire underbody—on the outside—and the trunk interior are sprayed with a plastic deadener which reduces drumming and prevents corrosion.

The windshield is of two-piece construction using a large-area safety glass, curved in one plane. The large rear window is of tempered plate glass having a compound curvature. Side windows are inclined at an angle of 17

degrees and this is said to reduce reflections from the side. Windshield wipers are operated by a single vacuum motor mounted accessibly on the dash under the hood, driving the windshield wipers by means of a Bowden wire and pulleys. Wiper blades are of the new flexible type designed for curved glass applications.

Outside door handles are trigger-operated with heavy hand grips. All doors are hinged at the front. Unusual feature of body interior treatment is the provision of a "two-person" arm rest in the rear seat—16 inches wide—in Commodore sedans and six-passenger coupes.

Super-Eights and Commodore Sixes are available in three- and six-passenger coupes or sedans; Super-Sixes in three- or six-passenger coupes, broughams, sedans, and convertible broughams; while Commodore Eights are available in six-passenger coupes, sedans, and convertible broughams. All body types are offered in 12 solid colors and five two-tone combinations.



- Buell Air Horns are tops in warning signal efficiency.
- Installed as original equipment on many Trucks and Buses.
- They reduce maintenance costs by decreasing stops, starts and slowdowns.
- All records prove that they save tires, brakes, clutches and gears.
- Cut gas and oil consumption.

With a Buell the driver has greater security, maintaining a steady cruising speed. Slowing a 20 ton load from 50 MPH to 30 MPH means destroying a lot of energy thru brake lining and tires. It is replaced by burning more gasoline, increasing load on engine and tires again, to regain speed. This all costs money. We believe a Buell Air Horn is worth \$100.00 yearly on any heavy highway vehicle. Then remember a Buell will last more than 10 years. How would you rate a \$100.00 investment that earned \$100.00 yearly for 10 years. Ask the man who has a Buell.

BUELL MANUFACTURING CO.
2975 Cottage Grove Ave., Chicago 16, Ill.

Airbriefs

(Continued from page 44)

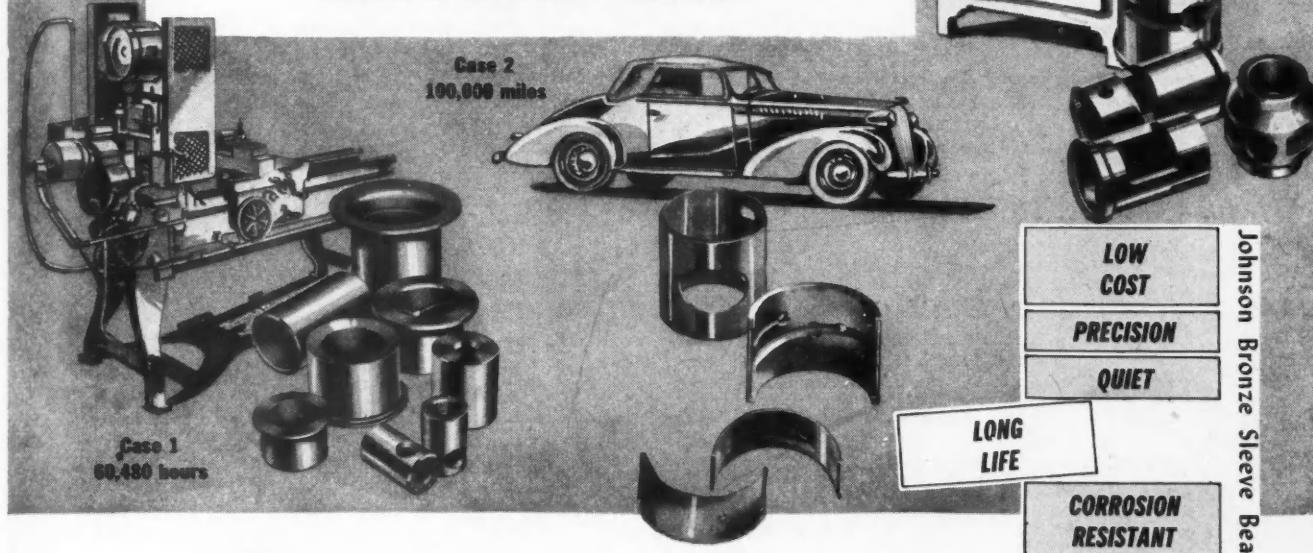
Rocket Tests Televised

Two modern scientific developments, television and rockets, have been wedded in a new technique developed by engineers of Aerojet Engineering Corp. and General Electric. Visual observation of the jet efflux of a rocket engine on the test stand is still one of the most important indices of its performance but the hazards are growing for observers standing near the blast. Out in Azusa, Calif., a G-E television unit has been installed adjacent to the Aerojet rocket test pit with the receiver located several yards away inside a comfortable and well-protected projection room. Engineers are thus enabled to watch a close-up of the rocket tests without danger, noise or smoke.

Internal Antenna

Radio Corp. of America has developed a new slot antenna for aircraft which fits entirely within the contour of a wing or fuselage, thereby completely eliminating the drag or conventional installations. The antenna consists of a short rod mounted in a slot in the wing, the opening being covered by a Plexiglas plate. A hole in the plate permits drainage. The antenna is used for radio altimeters, signals being transmitted downward through the Plexiglas panel to the ground and reflected back up into the antenna.

PERFORMANCE RECORDS start with the BEARINGS



BUYERS of all types of equipment are becoming more particular. Besides checking the price, they're asking . . . "How long will it run . . . at top efficiency . . . at lowest operating cost?" Performance records are becoming a major sales factor.

No mechanical unit can be any better than its bearings. The only way to be sure of your bearings is to: 1. Determine the correct type for each application and 2. Get bearings made to your specifications.

Johnson Sleeve Type Bearings have achieved an enviable reputation for long life and economical operation. Our up-to-date methods . . . our skilled help . . . and more than forty years of exclusive bearing experience . . . enable us to help manufacturers create new performance records. We help you decide which types of bearings will best serve your needs . . . we will produce them exactly to your specifications . . . and we can deliver them on time. Why not call us in NOW?

JOHNSON BRONZE CO.
625 South Mill Street

New Castle, Pa.

**JOHNSON
BRONZE**
SLEEVE BEARING HEADQUARTERS

BRANCHES IN
18 INDUSTRIAL
CENTERS

Johnson Bronze Sleeve Bearings Give You Every Worthwhile Advantage

- LOW COST
- PRECISION
- QUIET
- LONG LIFE
- CORROSION RESISTANT
- UNIT CONSTRUCTION
- LOAD CARRYING CAPACITY
- HIGH RESISTANCE TO SHOCK
- LOW COEFFICIENT OF FRICTION
- EASY TO INSTALL
- CONFORMABILITY
- NATION WIDE SERVICE

Case 1

A prominent user of machine tools reports that the Johnson Sleeve Bearings installed in one of his units in 1927 are still operating efficiently after 60,480 hours of service.

Case 2

A traveling salesman tells us of the Sleeve Bearings installed in his car . . . 1937 model. After over 100,000 miles they are still delivering economical performance.

Case 3

A refrigerator owner reports that in a recent overhaul he checked the bearings. After twenty-five years of continuous service the Johnson Bronze Sleeve Bearings show no signs of wear.

Styling for the Future

(Continued from page 43)

passenger car divisions.

It was recognized long ago that the stylist must be far ahead of manufacturing with new model designs that will reflect the trend. Consequently 1949 and 1950 models are pretty well disposed of and the styling section currently is working on 1951 styling.

An interesting feature of the styl-

ing section layout is that each GM division has its own studio to which only its own personnel and selected members of the styling section staff are admitted. This gives each division an opportunity to develop its own ideas and to preserve its identity. The actual designing of a new model is a ramified process which winds a tor-

tuous course before the final product is ready for production. It begins with a conference of divisional engineers, styling section management, and the chief designer of the divisional studio. Scope and limitations are worked out there after mechanical specifications, changes, wheelbase, and overall dimensions are discussed, and the design program is tentatively mapped out.

The designers then canvass their files and other sources, including the development design studio, for ideas, sketches and drawings and after collating this material draw a number of perspective sketches depicting their ideas of the completed model. This is supplemented with more detailed drawings of the various parts, such as grilles, bumpers, etc. When a number of designs have been approved by the styling section management, divisional executives review them and choose one or two for further development.

The next step is creation of a full-size blackboard drawing, showing window and windshield openings, seat positions, headroom and legroom, and overall heights, widths and length. This is followed by full-size rendering of a direct side view, a front view, and rear view, all done in colors with reproduction of chrome and lacquered surfaces as true as is humanly possible to obtain. If the divisional executives or styling section management request changes after reviewing the color drawing, corrections are made with overlays.

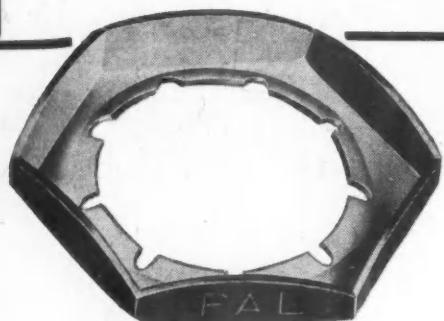
An interior mockup comes next, consisting of a body skeleton in which the interior may be completely finished. This permits checking legroom and headroom, relation of seats to windows and windshield, angle of steering wheel, and its relation to the seat. A full-size clay model also is built with all parts of the car down to the smallest detail on the smallest ornament modeled to a tolerance of plus or minus 1/16 in. Although expensive in time and money, the full-size clay mockup is considered well worth while. Many faults of the two-dimensional drawings are readily apparent, modelers can change surfaces quickly and correct errors in proportioning, and it enables designers to work out ideas difficult to develop on paper.

When the clay model is approved, a hollow plaster reproduction of body, hood, and fenders is cast in one piece and mounted on a chassis. All metal parts, such as grilles and door handles, are mounted in place, glass is installed, the interior trimmed, and the model is painted inside and out to look exactly like a production car. Meanwhile the interior design studio works out details of interior finish, including upholstery fabrics, headlining, door panel design, blending of panels, and choice of colors.

(Turn to page 74, please)

Why PALNUT LOCKNUTS

*are used on tough automotive applications**



The Assembly Stays Tight!

"Palnut" double-locking action is unaffected by vibration — holds regular nut to original tightness.

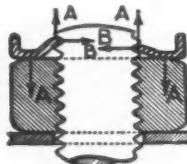
The Cost is Low!

"Palnut", plus regular nut, costs less than most other locknuts and nut-and-lock combinations.

Installation is Fast!

"Palnuts" spin on bolt freely, lock tight with wrench. Well-adapted to assembly with power tools.

Double
Locking
Action



Arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt thread and downward on the regular nut (A-A), securely locking both. This same locking principle is found in our popular Auto License Fasteners. A set will be sent free on request on your company letterhead.

*USED ON: Connecting Rods, Brake Parts, Exhaust Manifolds, Body Hold Down, front and rear engine mountings and many other applications.

Send details of assembly for samples and data

THE PALNUT COMPANY

60 Cordier Street

Detroit Office: 3-213 General Motors Bldg.

Irvington 11, N. J.

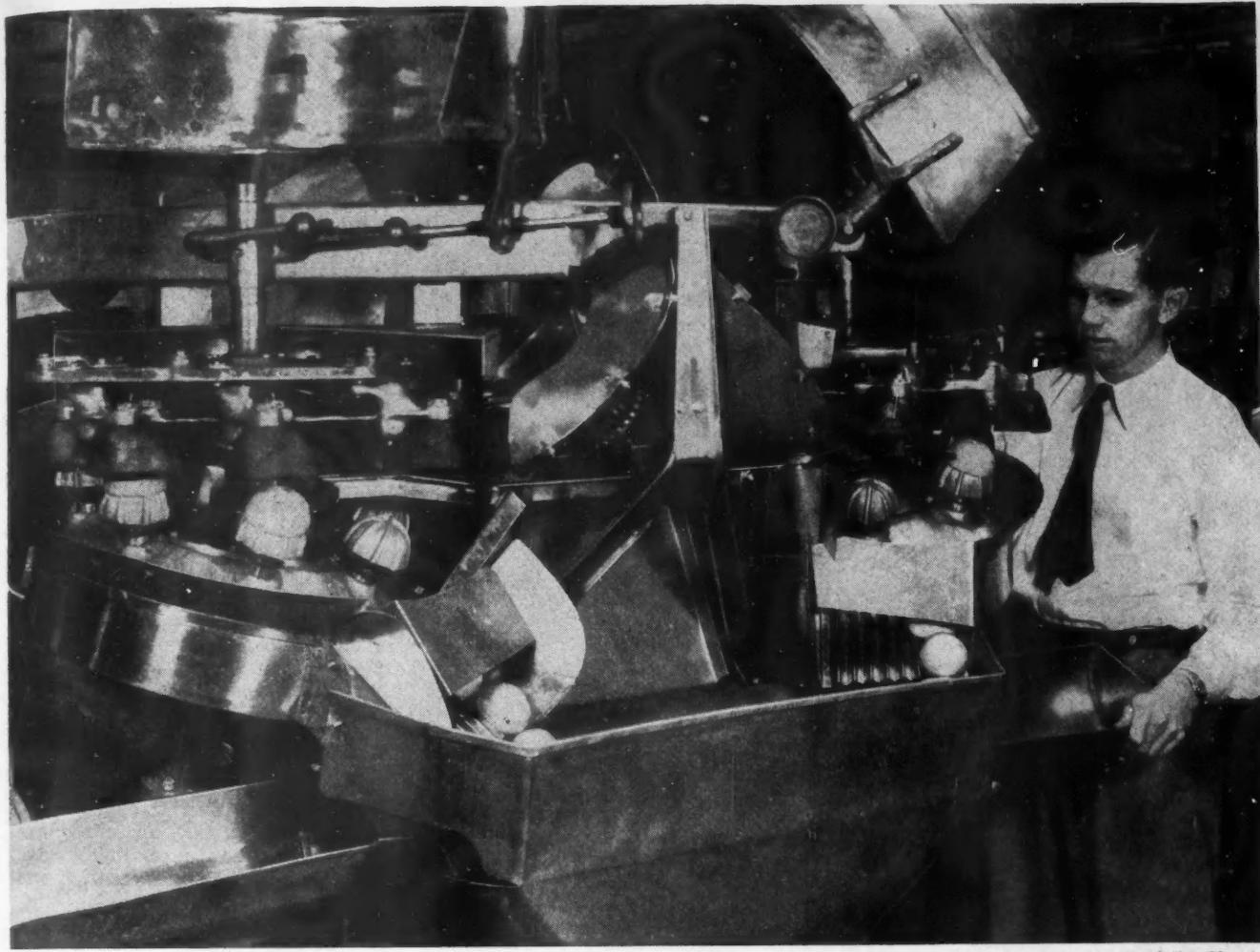


Photo courtesy Brown Citrus Fruit Machinery Co.

Juice cups molded by Kirkbill Rubber Co.

A Squeeze Play that benefits everyone

FLOODS of vitamin-rich juice are whirled from ripe oranges by this automatic Citrus Juice Extractor.

The squeeze is on the orange halves as they are gripped and firmly pressed against whirling metal cones by cups made from a compound of Geon polyvinyl resin and Hycar American rubber.

Because this composite material is unaffected by fruit oils, acids, moisture, because it is impervious to contamination, because the cups made from it perfectly perform their gripping function despite variation in the size of fruit, important benefits result.

Ripe fruit is fully utilized, waste prevented, a healthful food product is available on your grocer's shelves at modest price, the owners of the ma-

chine have substantially reduced the cost of maintenance and operation.

Geon polyvinyl resins and Hycar American rubber are materials for which new cost-saving, problem-solving uses are discovered almost daily. Molded, calendered, cast, or used as impregnants for fibres and fabrics, their versatility may contribute importantly to the product you make and to articles you use daily.

B. F. Goodrich Chemical Company makes no finished products from Geon or from any other raw material. However, we will be glad to work with you on any special problems of application. We are particularly interested in developing new end uses for these materials. For more information please write Department HD-12, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.



Hycar
Reg. U. S. Pat. Off.
American Rubber

B. F. Goodrich Chemical Company

GEON polyvinyl materials • HYCAR American rubber • KRISTON thermosetting resins • GOOD-RITE chemicals

A DIVISION OF
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FOR LIGHT AIRCRAFT

MARVEL-SCHEBLER CARBURETER DIV.
BORG-WARNER • • FLINT 2 MICHIGAN

Styling for the Future

(Continued from page 72)

After all concerned have approved the clay model, templates are made of the surfaces of the car at intervals of ten inches. From these, the body drafting department makes a complete draft of the body, hood, and fenders. Detailed close tolerance drawings of the other component parts, such as grilles, bumpers, etc., are made by the sheet metal and mechanical layout department. Prints then are made and skilled craftsmen in the wood and metal shops build the body and other parts in wood or metal. Chrome plated parts are made of metal and those to be painted are made of wood. All details of the car are faithfully reproduced, including doors that open, instrument panel, glass in the windows, seat frames, and many other features. The model is then covered with cloth and filler and sanded until the surface is as smooth as that of a production metal job. Spraying with lacquer and rubbing down give the model a high luster. Finally it is trimmed, seats are upholstered and installed and garnish panels and instrument panel controls and decorations are fitted into place. A final showing to the divisional executives sometimes results in minor changes, but in the main the styling section is through with its job.

While the foregoing gives the impression that creating a new model is merely a series of well defined steps, it actually is much more than that. Back of each phase is hours of research, painstaking work, difficult decisions, and differences of opinion that must be reconciled. It involves not only the inanimate mechanics of working with materials, but also the more difficult and delicate realm of unpredictable human reaction. But the GM styling section has completed its first 20 years with a notable record of achievement. Changes have been made to care for additional activities or to increase efficiency and more will be made as conditions demand them. You can't stay static in styling.

Presently located in the GM Research building, the styling section is finding itself cramped for adequate facilities and a new building has been planned for it in connection with the GM Technical Center. Plans for starting the Center were deferred by GM last year, but it will be built eventually. The styling section will occupy a building approximately 850 ft by 250 ft which will be located at the southern end of the esplanade and face north to obtain the best advantage of the north light. It will be well equipped and spacious with screened terraces for judging cars under outdoor conditions.



LEONARDO MIGHT HAVE FLOWN

LEONARDO DA VINCI'S genius conceived a technically sound airplane and even the principle of the cylinder and piston (the latter in a steam cannon). But nearly four centuries passed before powered flight was a reality at Kittyhawk. So far was he ahead of the world that no man lived who could take up the torch which he kindled in the world's struggle for emancipation from creeping travel and crushing toil.

Today, internal-combustion power is a servant of man in a thousand ways that even a Leonardo could not have conceived. The matériel of agriculture, commerce and industry moves freely through the world's trade channels on planes, ships, trains and trucks powered by gasoline and Diesel engines. Construction, re-construction, eventual world abundance are within reach with internal-combustion engines at their specialized tasks.



SERVING POWER WHICH SERVES MANKIND

American Bosch serves the internal-combustion-engine industry in three vital ways:

ENGINEERING. 1,200,000 *man-hours* of it have been poured into Diesel fuel injection alone—other millions into ignition.

PRODUCTION. Premium performance has been a consistent goal in the production of hundreds of thousands of Diesel injection systems and millions of electrical units.

MAINTENANCE. The world over, American Bosch authorized service stations keep the equipment operating efficiently.

AMERICAN BOSCH CORPORATION, SPRINGFIELD 7, MASS.

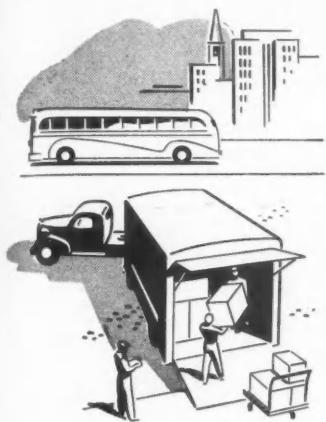
AMERICAN BOSCH
PARTNERS IN THE PROGRESS OF POWER

DIESEL FUEL INJECTION • AUTOMOTIVE AND AVIATION ELECTRICAL PRODUCTS

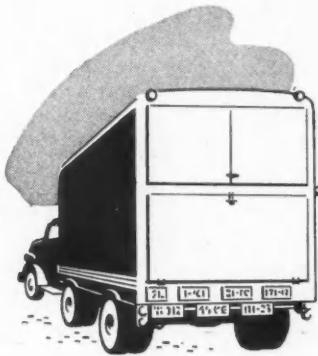
NEXT BIG ADVANCE
in designing
LIGHTER TRUCKS AND BUSES



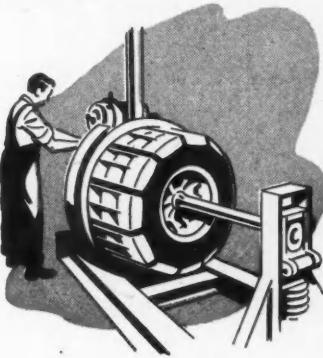
Aluminum wheels . . . made of high strength
Alcoa castings . . . will cut wheel weights 50%!



IF YOU'RE SELLING truck fleet owners operating against state weight restrictions, or bus operators bucking fuel and tire bills, here's good news. You can buy Alcoa Aluminum high-strength castings and finish them in your own plant! Aluminum will cut wheel weights in half—add a big chunk of payload!



LIGHT WEIGHT means lighter taxes. How much will fleet operators save in yearly license fees if you cut their wheel weight in half? Their lighter weight will also make these wheels easier on tires, suspension system and drive—will improve riding quality!



SHARP CURVES AT 50 MPH! Alcoa laboratories put aluminum wheels through a test that duplicates stress of sharp turns at high speeds. The big machine grips the tire and spins the wheel while the shaft is pulled off center to create side strain. This and other tests mean lighter weight and safety, too.



ON THE ROAD, as well as in the laboratory, wheels made of Alcoa Aluminum Castings have come through millions of miles of actual running. Aluminum wheels have proved in operation to be as strong as wheels of heavier metals!



ALCOA'S PIONEERING KNOWLEDGE can help solve your wheel design problems. Light metals know-how—59 years of it—coupled with complete modern testing devices including x-ray inspection, torsion and fatigue testing, assure dependable service from Alcoa Castings.



DESIGN HELP Alcoa stands ready to assist you in making designs for cast aluminum wheels that will meet your requirements.

Sales offices in principal cities, or write
ALUMINUM COMPANY OF AMERICA, 2110
Gulf Building, Pittsburgh 19, Penna.



BUS AND TRUCK WHEELS OF ALCOA ALUMINUM CASTINGS

Russian Power Lift for Direct-Mounted Implements

IN RECENT years it has become customary to mount agricultural implements directly on tractors and to provide the latter with so-called power lifts for raising and lowering the implements. One such power lift, specially developed for the Russian Universal tractor, was described and illustrated in a recent issue of the German periodical ATZ, from which the accompany-

ing drawings are reproduced. The Universal tractor, by the way, is said to be a copy of an earlier model of International Harvester Company's Farmall.

The power-lift unit is installed on the tractor after the cover plate of the rear-axle housing has first been removed. Referring to the drawings, Figs. 1, 2 and 3, worm shaft 1 below

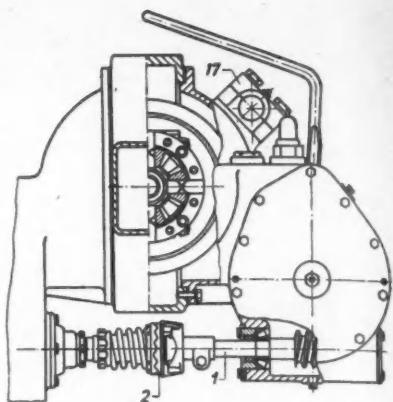


Fig. 1—Side elevation view of the Russian power lift.

the axle is driven from the power take-off shaft through a safety coupling 2 of the same type as used for driving the mechanism of self-binders. On lift shaft 3 is loosely mounted a cast-iron hub 4, to which are riveted the worm wheel 5 and a driving drum 6. The drum is provided with ratchet teeth on its outside, while its inner surface is of sinusoidal form. Adjacent to the driving drum there is an indexing disk 7 which is provided with two oppositely located semi-circular notches. This disk also is free on the lift shaft. Mounted on studs secured into the indexing disk are two pawls 8 which engage the ratchet teeth on the drum under the influence of tension springs. The indexing disk further carries, on stud 9, a swinging arm 10 with driving roller 11 at its free end. Spring 12, which extends between the indexing disk and the swinging arm, presses roller 11 into the sinusoidal depressions of driving drum 6.

To the splined end of control lever 13 is secured the roller lever 14 with control roller 15. The hub of indexing disk 7 extends through a bearing in the housing, and outside the housing it has the power-lift crank 16 fastened to it. This crank connects by a linkage with the lever which raises or lowers the implement. Bearing 17 at the top of the housing serves to attach the im-

(Turn to page 80, please)

An advertisement for DOLE Thermostats. The top half features a stylized illustration of a car engine with the text "FUNDAMENTAL IN CAR PERFORMANCE:" above it and "Positive Motor Temperature Control" below it. Below this is a photograph of a DOLE thermostat housing. The text "with DOLE Thermostats in a range of types for every car" is overlaid on the image. To the left is a photograph of a cylindrical DOLE thermostat component.

Whatever tomorrow's design problems may be—it is certain that controlled cooling, as achieved by advanced-type Dole Thermostats, will continue as an important factor in performance. Positive temperature control—the prime function of DOLE Thermostats—means quick warm-up—a sweet running motor—reduced crank case dilution...and worth-while savings in gas, oil and motor wear.

THE DOLE VALVE COMPANY
1901-1941 CARROLL AVENUE, CHICAGO 12, ILLINOIS
LOS ANGELES DETROIT PHILADELPHIA

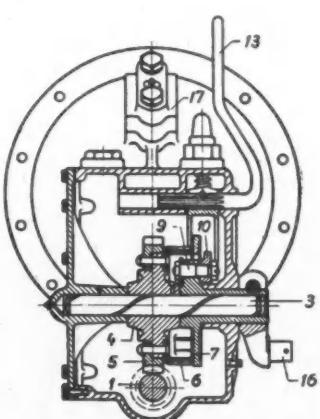


Fig. 2—Cross section of the power lift.

Building a Strong CONSTITUTION



On such mighty airliners of tomorrow as the giant Lockheed Constitution, Foote Bros. Power Units and Foote Bros. "A-Q" (aircraft quality) Gears are helping to solve engineering problems encountered by the designers.

The operation of this ship demonstrates the effective method of control by specially engineered Actuators and Power Units produced by Foote Bros.

In the Pratt and Whitney engines that power the Constitution are Foote Bros. "A-Q" Gears—gears that achieve a perfection considered impossible a few years ago.

Foote Bros. Power Units and Actuators offer a practical method of controlling linear and rotary motion within an exacting time cycle and within a confined space envelope. Whether you manufacture airplanes or road construction machinery—printing presses or other mechanical equipment, these units may offer your engineers ideas on better methods of power control.

For any power transmission application requiring high speed, greater efficiency, light weight, compactness and low noise level, Foote Bros. "A-Q" Gears open up new possibilities in design.

Foote Bros. engineers stand ready to assist in the development of gears and control devices to solve the problems with which you are faced.

FOOTE BROS. GEAR AND MACHINE CORPORATION
Dept. F, 4545 South Western Boulevard • Chicago 9, Ill.

FOOTE BROS.

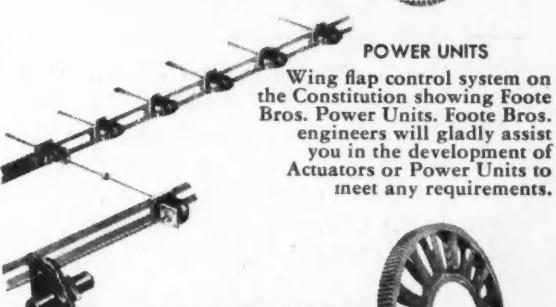
Better Power Transmission Through Better Gears

"A-Q" (aircraft quality) GEARS

"A-Q" Gears reach a new perfection in accuracy which permits excessive speeds, high load capacity, minimum weight, increased efficiency and low noise level. If you require better gears, discuss your needs with Foote Bros. engineers.



POWER UNITS



Wing flap control system on the Constitution showing Foote Bros. Power Units. Foote Bros. engineers will gladly assist you in the development of Actuators or Power Units to meet any requirements.

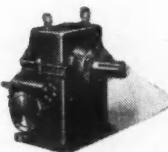
COMMERCIAL GEARS

In the two large plants of Foote Bros. are complete facilities for producing quality gears in quantity. If you require helical, spur, worm or bevel gears, call on Foote Bros.



SPEED REDUCERS

Nearly century of manufacturing experience is back of Foote Bros. speed reducers—available in sizes and ratios to meet practically any speed reduction problem. Helical reducers in single, double and triple reduction types. Worm reducers in single and double reduction.



Three bulletins on Foote Bros. products are available. Check the coupon for the ones you are interested in.

- FOLDER "WHATEVER YOUR NEEDS IN GEARS"
- BULLETIN "AIRCRAFT QUALITY GEARS"
- BULLETIN "FOOTE BROS. POWER UNITS"

Name.....

Address.....

City..... State.....

Power Lift

(Continued from page 78)

plement to the tractor.

When the power lift is to be operated the power take-off shaft is coupled to the worm shaft. This causes worm shaft 1, worm wheel 5, and driving drum 6 to rotate. Disk 7 remains stationary, because roller 15 of control lever 14 is in one of the semi-circular notches of the indexing disk and holds it. Swinging arm 10 of the indexing

disk is being pressed inward by the same control roller, and its roller 11 is out of the sinusoidal depressions on the inner surface of the rotating drum. If now control lever 13 is moved in the direction of the arrow, by overcoming the pressure of the spring acting on it, roller 15 leaves the semi-circular depression in disk 7 and at the same time releases swinging arm 10. Spring 12 then forces roller 11 into one of the depressions on the inner surface of driving drum 6. This causes swinging arm 10 and disk 7 to be carried along with driving drum 6, and lifter crank 16 is moved around its axis.

After a motion of 180 deg roller 15

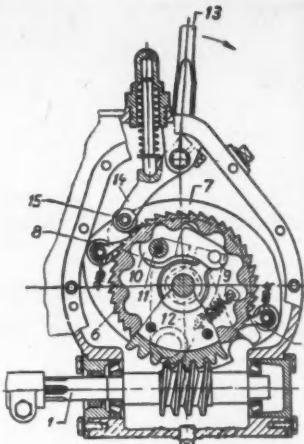
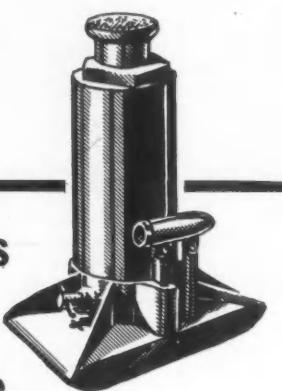


Fig. 3—Longitudinal section of the power lift.

6 out of 8*
leading makers of auto jacks
use OAKITE
CLEANING MATERIALS



*Rated AAAA in Thomas' Register

THOSE six jack manufacturers know that Oakite materials give them fast, efficient, cleaning, descaling, paint-stripping, rust-proofing and related surface preparation jobs. They regularly specify and use Oakite materials for trouble-free cleaning . . . low per unit costs.

How You Can Profit

But, let's say you haven't used Oakite materials or relied on Oakite service for your cleaning procedures. We want you to know that Oakite produces over 70 alkaline, solvent and acidic type materials for every conceivable cleaning and surface preparation job.

No matter the product you make, chances are cleaning plays a big part in its production. If so, contact your near-by Oakite Technical Service Representative for the Oakite materials and methods sure to put these cleaning procedures on an efficient, low-cost basis. He will put the chemistry of cleaning to work for you . . . speed up your production-cleaning procedures . . . help you to produce a high grade product at low per unit cost. Drop a note to Oakite Products, Inc., 28A Thames St., New York 6, N. Y. We'll have him call.

OAKITE

REG. U. S. PAT. OFF.
SPECIALIZED CLEANING MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. & Canada

enters the second depression in disk 7, thereby stopping the disk. At the same time roller 15 forces swinging arm 10 with its roller 11 out of the sinusoidal depression on the driving drum, and disk 7 and power lift crank 16 come to rest. Reverse motion of the lift crank at the moment roller 11 is disengaged is prevented by pawls 8.

A half revolution of the lift crank corresponds to the distance the implement must be raised. During the next half revolution the implement is lowered. The worm-gear ratio is so chosen that at normal engine speed it takes two sec to lift the implement or to lower it. During this period the tractor moves forward 6.5 ft when in first gear and about 10 ft in second.

One disadvantage of the power lift here described would seem to be that it prevents the use of the power take-off for other purposes. This, however, is said to be of no particular importance on the large Russian cooperative farms, where a number of tractors are always assigned to exclusive use for cultivating purposes.

CALENDAR

Conventions and Meetings

Natl. Motor Boat Show, New York City	Jan. 9-17
Soc. of Automotive Engineers Annual Mtg., Detroit	Jan. 12-16
Natl. Materials Handling Exposition, Cleveland	Jan. 12-16
Natl. Auto Dealers Assoc. Exhibition, Chicago	Jan. 25-29
Institute of the Aeronautical Sciences—Annual Mtg., New York	Jan. 26-29
International Sports, Travel and Boat Show, Chicago	Feb. 27-Mar. 7
Tool Engineers Industrial Exposition, Cleveland	Mar. 15-19
Chicago Production Show, Chicago	Mar. 22-24
The Inst. of the Aeronautical Sciences Natl. Flight Propulsion Mtg., Cleveland	Mar. 26
Natl. Assoc. of Corrosion Engineers Mtg., St. Louis	Apr. 5-8
Southern Mch. & Metals Exposition, Atlanta	Apr. 5-8
32nd International 500-Mile Race, Indianapolis	May 11

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BORG-WARNER
ENGINEERING
BW
PRODUCTION



Relaxation for Drivers

A normally relaxed driver is the best and safest driver. He can best relax when he knows that everything is under control. Essential to his control is instant, positive response of the clutch to easy pedal pressure.

Long semi-centrifugal clutches—because of this positive yet easy action—help drivers to relax. Since 1922, Long clutches have been standard equipment on millions of cars, trucks, buses and tractors.

LONG MANUFACTURING DIVISION
BORG-WARNER CORPORATION
Detroit 12, and Windsor, Ontario

LONG
CLUTCHES • RADIATORS • OIL COOLERS

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April 5-8
May 31
STRIES

PERSONALS

Recent Personnel Changes and Appointments at the Plants of Automotive and Aviation Manufacturers and Their Suppliers.

Packard Motor Car Co.—Karl M. Greiner has been made General Sales Manager of the company. Clare E. Briggs has been made Asst. General Sales Manager.

General Motors Corp., Pontiac Motor Div.—B. B. Kimball, appointed Advertising Manager.

General Motors Corp., Chevrolet Motor Div.—Alton A. Way made Manager of River Road plant, Buffalo.

Ford Motor Company — Charles E. Carll appointed Director of Public Relations and R. E. Roberts, head of newly-formed department of Employe Relations.

Henry J. Kaiser has announced the appointment of Robert C. Elliott as his executive assistant. Mr. Elliott's headquarters will be in New York City.

Kaiser-Frazer Detroit Engine Div., Kaiser-Frazer Corp.—Kenneth J. Flood

made Factory Manager.

Kaiser-Frazer Corp.—Walter de Martini, appointed Director of Service.

Crosley Motors, Inc. — Stanley E. Kess, Asst. Sales Manager has been made a director of the company.

Willys-Overland Motors—Joseph M. Brennan made General Manager of the Drop Forge Div. and George F. Bluth, Director of Manufacturing Facilities and Methods.

Willys-Overland Motors — W. C. Giessler, Staff Asst. to George F. Bluth, and W. L. Ulrich, Supt. of Development Group and Vendor Tooling.

Mack Trucks, Inc.—W. E. Day appointed Director of Research.

American Brake Shoe Co., Engineered Castings Div.—N. George Belury appointed Vice-President; Harry C. Platt appointed Works Manager.

Bendix Aviation Corp., Scintilla Magneto Div. — George M. Anger, made Western representative with headquarters in San Francisco.

Natl. Automobile Dealers Assoc.—Guy Arthur, appointed Special Counsel for Employee-Relations program.

Borg-Warner Corp., Ingersoll Steel Div. — Joseph A. White made Chicago Works Manager; Milo F. McCammon, Kalamazoo Works Manager. Robert S. Ingersoll is Vice-President of the division, in charge of manufacturing at the Chicago, Kalamazoo and Evansville, Indiana plants.

Aircraft Industries Association—Dwane L. Wallace, President of Cessna Aircraft Co., has been elected Chairman of the Personal Aircraft Council.

Indian Motorcycle Co. — Gardiner S. Platt has been made Asst. to the President, Ralph B. Rogers.

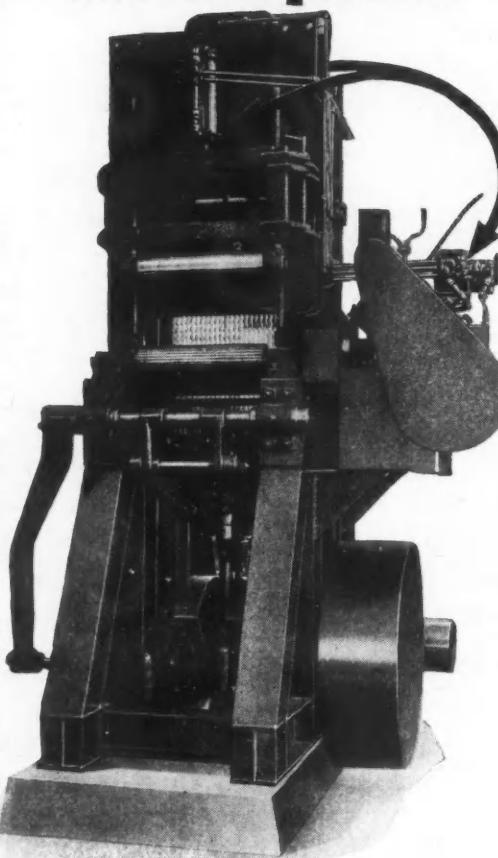
General Electric Co., Apparatus Dept.—W. V. O'Brien has been named Asst. General Manager of Sales.

General Motors Corp., Fisher Body Div.—William H. Minton, Supt. of Quality Standards Dept.; W. S. Wells, Plant Engineer and Frank J. Burke, Supt. of the Materials Dept.

The Standard Products Co.—Harry D. Myers appointed Executive Vice-President, Director and General Manager of the company's eight plants.

The Weatherhead Co. — Thomas G. Carey made Purchasing Agent of Production Parts and Sub Contracting.

Vanadium Corp. of America—Harry E. Orr appointed Asst. Vice-President and Manager of District Sales.



Gang-Saw Rolls "NOPAK Operated"

The Johnson Manufacturing Co., Seattle, Wash., builds Cant Gang Saws of this type in various sizes and capacities. The model shown employs two NOPAK Model "A" Air Cylinders (6" x 12") with Self-Regulating Cushions at both ends of the stroke. As the rolls are lowered by the action of the cylinders, they apply pressure on the cant (log) so that the feed-rolls engage the cant to feed lumber into the saw. Two $\frac{3}{4}$ " NOPAK 4-Way Valves provide positive, accurate control of cylinder action at 100 p.s.i. air pressure.

This application indicates that NOPAK Valves and Cylinders are made for rugged, heavy duty service on machines which you may build for resale or use for production operations in your plant.

Write for Bulletin 92-A.

GALLAND-HENNING MFG. CO., 2774 S. 31st St., Milwaukee 7, Wis.
Representatives in Principal Cities

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

Machine designers, tool engineers, production men...ask your NOPAK Representative for a copy of the NOPAK Application Manual.

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Your
Customers
Demand
Performance



Performance
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Reliable
Carburetion

Demand

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ThredKut*

INCREASED OUTPUT 4 to 1

... reports
JOHN L. MOROSINI
D. A. Stuart Oil Co.
Representative

"Prior to using THREDKUT,* this customer had tried several types of cutting oil in tapping 1½" dia. x 1" holes in very tough cast steel, with a maximum production of 50 tapped holes before sharpening was necessary. On switching to THREDKUT,* output immediately increased to 200 tapped holes between sharpenings. Here is another instance where THREDKUT* demonstrated its well-established reputation for licking a tough job."

John L. Morosini

ThredKut *

... Stuart's THREDKUT is a unique cutting oil carefully manufactured to insure the maximum benefits from controlled chemical activity. Its outstanding performance on really tough jobs has long been recognized and its flexibility proved through exceedingly widespread use. The many time-tested values built into THREDKUT are serving the leaders of the metalworking industry, increasing efficiency and reducing costs.

Ask to have a Stuart Service Engineer discuss your cutting fluid requirements. THREDKUT literature available on request.

**STUART service goes
with every barrel**
WRITE FOR DETAILS

D. A. **Stuart Oil Co.** LIMITED

2733 SOUTH TROY STREET, CHICAGO 23, ILL.

Publications

(Continued from page 56)

strength properties, as well as suggestions for welding dissimilar metals. A complete chart of the trade names of stainless alloys as produced by the mills of the country is included.

D-148—Indicating Recorders and Controllers

Leeds & Northrup Co.—A new, 16-page catalog Micromax Model R, Indicating Recorders and Controllers, covers all Model R's, includes complete specifications in easy-to-use, tabular form for automatic indicating recorders and indicating and recording controllers. Suggested chart numbers are also listed for the more commonly used ranges, together with other accessories and supplies.

D-149—Trojan Monorail Tractor

Detroit Hoist & Machine Co.—Bulletin No. 810 describes and illustrates the new Trojan Tractor, designed for overhead hauling along a monorail track. A dimension table and diagram, together with application drawing and photographic illustrations are included.

D-150—ArmaSteel—Cast Ferrous Metal

General Motors Corp., Central Foundry Div.—A new booklet, ArmaSteel, Cast for a Leading Role in Industry, gives information regarding the properties, advantages, fields of application and engineering data, as well as the company's manufacturing methods and controls of ArmaSteel.

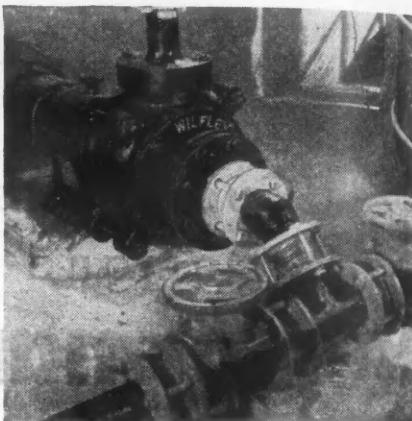
D-151—Radiac Grinding Wheels

A. P. deSanno & Sons, Inc.—Catalog 103 gives information on grinding wheels and recommendations for grinding. Each manufacturing process—Vitrified, Silicate, Resinoid, Rubber and Shellac—is covered separately, giving the grains and grades usually supplied with that particular process. Grinding wheel specifications are included.

D-152—Modern Automatic Machines

New Britain-Gridley Machine Div., The New Britain Machine Co.—A new, 12-page folder, Modern Automatics, pictures and describes the company's automatic turret lathes, screw machines, boring and chucking machines. Special features and characteristics of the various models are given, together with specifications. The last page contains views of the company's plants and a resume of its history.

AVOID COSTLY SHUTDOWNS DUE TO CORROSION...



SPECIFY

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EQUIPMENT FOR

CORROSION
RESISTANCE
THAT'S
MORE THAN
SKIN
DEEP

- Agitators
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- Fume Duct
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- Pumps
- Tanks
- Towers
- Many Others

HAVEG is a molded structural material that is completely acid and alkali resistant throughout its entire mass . . . it is not a lining nor a coating!

Large size equipment can be molded at low cost in one piece without seams or joints and installation accomplished easily and economically.



Send for Bulletin F-5 for complete design, engineering and application data.

AA-6-47

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Saturday night.



CLEANER COST CUT 72.5 %



DIRTY ENGINES COME CLEAN WITH PENNSALT CLEANERS

When you were a little boy, Saturday Night meant *one* thing: soap, water and a scrubbing brush.

But in the shop of a certain West Coast motor reconditioner, "Saturday Night" meant something else: high cleaning costs, with only fair results in removing oil, grease and carbon from used motor blocks.

Our Pennsalt representative called and showed their manager how he could save time and money with Pennsalt Metal Cleaners in their baths. Not only did this test give better cleaning with less cleaner loss, but best of all showed a 72.5% reduction in cleaner cost.

Now the manager's eyes shine like his motor blocks!

If you have a cleaning or scaling problem, let a trained Pennsalt technical representative help you solve it. Just write: Special Chemicals Division, Pennsylvania Salt Manufacturing Company, 1000 Widener Building, Philadelphia 7, Pa.... New York • Chicago • St. Louis • Pittsburgh • Cincinnati • Wyandotte • Tacoma • Portland, Ore.



METAL CLEANERS

88 YEARS OF SERVICE TO INDUSTRY

Romney

(Continued from page 29)

before the war.

After World War I, an attempt was made to thrust democracy upon them, and it failed — perhaps because they were not ready for it. The latest attempt to push them into totalitarianism ultimately will fail, too, but in the meantime the disorder and confusion of the economy will retard industrial recovery. American industry can look for lean years ahead in the European market. That is especially true of the

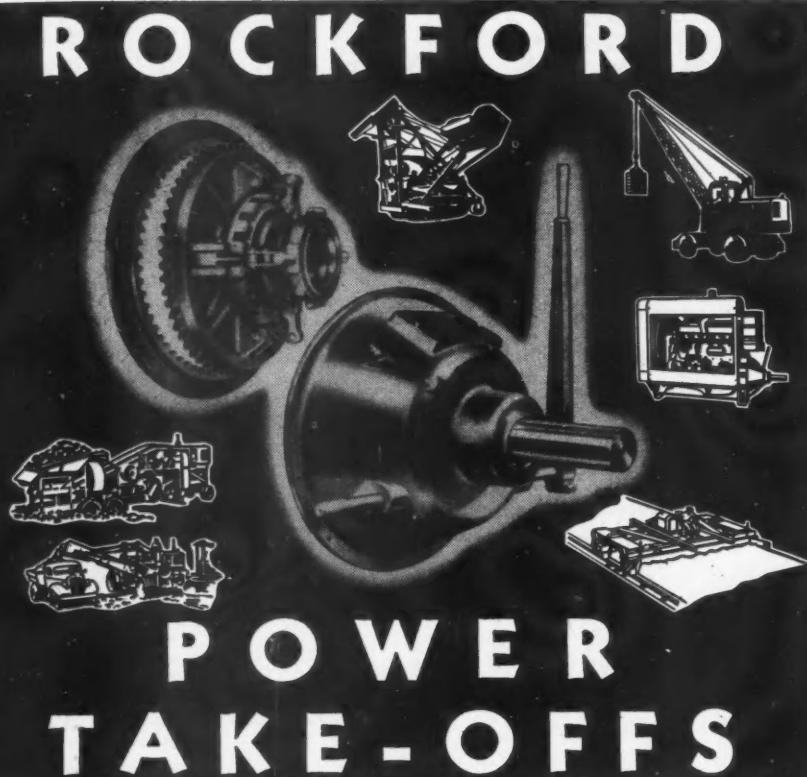
automotive industry because of the viewpoint of many governments that highway transport is not an essential part of the economy. The automobile and truck never became nearly as integral a part of the economy as it has in the United States, which helps explain the embargo and quota restrictions which several European countries have imposed on American vehicles. Another factor is that competing means of transport, principally railroads, are government-owned or controlled in some countries.

Confronted with a need for dollar exchange which can be built up only through greater exports, European gov-

ernments are arbitrarily limiting the use of highway transport through import curbs on vehicles and bans on use of gasoline, and thus are headed for increased distribution costs which will work great mischief with their chances to compete in foreign trade. Curbs on highway use are but one of the many examples of government restrictions that several European nations are accepting in the belief that they are lesser evils than the more inefficient, debilitating restrictions of complete regimentation under Communistic regimes.

The European automobile manufacturer today is laboring under difficulties that make the troubles of his American opposite number look rather small by comparison. In France, for example, the government not only is operating the Renault plant in competition with private industry, but also sets prices for all companies. As a result, one manufacturer is compelled to sell for 350,000 francs a car that costs 500,000 to build. Consequently, he loses 150,000 francs on each vehicle and has no incentive to increase output, because the more he builds the more he loses. The inevitable evil under such a system is that groups with the most political influence get the best break on prices.

If any further proof of the superiority of the American competitive system, free of government interference, is needed, comparative estimates of production for 1947 provide it. U. S. output this year will be between 4.7 and 4.8 million vehicles. According to the best estimates available, European production will stand at approximately 711,600 by year-end. There must be something well worth preserving in a system that enables the United States to build about seven vehicles for every one produced in Europe and to sell 90 per cent of them to American people, whereas some other countries export 90 per cent and sell one at home for three to four times the price of a comparable American built product.



SELF CONTAINED UNIT

WIDE RANGE OF SIZES

CONSERVATIVE RATING

ROLLER BEARINGS

FINE ADJUSTMENT

ACCURATE BALANCE

S.A.E. DIMENSIONS

* The housing supports the drive shaft, which is mounted on a main bearing in the housing and a pilot bearing in the engine flywheel. The heavy-duty clutch is mounted on the drive shaft, which is extended to serve as the output shaft for the external drive, and may carry a pulley, gear, sprocket, or drive through a coupling.

Send for This Handy Bulletin Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.



ROCKFORD CLUTCH DIVISION

315 Catherine Street, Rockford, Illinois, U.S.A.

BOOKS ...

GREY-ROCK BRAKE SERVICE MANUAL, published by United States Asbestos Division of Raybestos - Manhattan, Inc., Manheim, Pa., and distributed through distributors and jobbers of Grey-Rock brake linings. Price \$2.00.

This new Grey-Rock Manual contains 48 pages and cover. Cover printed in two colors on heavy tag stock to withstand hard use. The Manual contains a Trouble Shooting Chart, and general instructions for the method of balancing all types of brakes. In addition, the brake systems for all makes of cars are shown in drawings with step-by-step instructions provided for relining and adjustments. These drawings and instructions cover all the new brakes including the self-adjusting brakes on Studebaker 1947 cars, brakes on Kaiser-Fraser cars, Ford brakes on 1946 and 1947 models, Timken DP brakes; description of the operation of Mico Hy-par and Hy-con Master Cylinders; Hydrovac and Lathan Uni-vac Boosters; Wagner Rotary Air Compressor; Bendix-Westinghouse Roto-Chambers; and brakes on older model cars.

(Turn to page 88, please)

"MAKE A TON OF SHEET STEEL
GO FARTHER"

Specify—



This is no idle promise. It is a proved fact, demonstrated day after day in the production of widely varied parts and products. Three tons of N-A-X HIGH-TENSILE are yielding as many finished units as were previously yielded by *four* tons of carbon sheet steel.

This "new arithmetic in steel" is helping overcome steel shortages for scores of manufacturers. They are taking advantage of N-A-X HIGH-TENSILE's greater strength and corrosion-resistance to reduce sections an average of 25%—and still provide greater strength and durability

than can be obtained with thicker sections of mild-carbon steel.

At a time when America must make fullest use of its steel-producing capacities and conserve its natural resources, the trend to N-A-X HIGH-TENSILE has national significance. Each ton produced represents a potential 33% increase in finished goods. Each ton used enables the manufacturer to get 33% greater usefulness out of his steel supply.

Investigate the opportunity to make each ton of sheet steel go farther—through the superior quality of N-A-X HIGH-TENSILE.

GREAT LAKES STEEL CORPORATION

N-A-X ALLOY DIVISION, DETROIT 18, MICHIGAN • UNIT OF NATIONAL STEEL CORPORATION

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BOOKS

(Continued from page 86)

TORQUE CONVERTERS or TRANSMISSIONS (Third Edition) by P. M. Heldt, Nyack, N. Y. Completely revised, this third edition contains much new material, particularly the chapters on Hydrokinetic Torque Converters and Automatic Stepped Transmissions. The principles of certain transmission types, such as that based on inertia, are more fully explained with the use of diagrams. In addition some inaccuracies, which inevitably occur in a first edition, have been eliminated by the author. About 30 more illustrations will be found in this edition, including those of a number of new transmissions that have been brought out since the end of World War II.

"MACHINE SHOP ESTIMATING," by W. A. Nordhoff, pub., McGraw-Hill Book Co., 486 pp., 319 illus. This is the first edition of a text originally developed by the author, machine shop estimator, Douglas Aircraft Co., Inc., to provide a quick and basic training in estimating costs by untrained personnel during the war. The problem was particularly acute in the aircraft industry where standards for mass production were practically non-existent. Not only people assigned to manufacturing departments but purchasing agents and Army and Navy agents had to be given the tools with which to evaluate cost estimates and bids by outside vendors. It is claimed that the methods covered in this text stood the test of actual performance for over four years. From the standpoint of organization, the book is divided into chapters each concerned with a specific type of metal cutting operation.



Do YOU have a pressure measuring problem? The **DYNAGAGE** May be your solution

This instrument is the culmination of years of research in pressure measuring problems by the Research Laboratories Division of General Motors Corporation. Developed primarily for measuring combustion and manifold pressures in automobile, aircraft and diesel engines, the DYNAGAGE was drafted during the war for research on explosives, rocket and jet engines, launching ramps, gun pressures, hydraulics and other applications.

Now the DYNAGAGE and the years of pressure measuring experience is made available to you through Photocon Research Products and we welcome the opportunity to help you with your immediate pressure measuring problems.

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PEAK PRESSURES

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DETONATION

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RATE OF PRES. RISE

CYCLIC PRESSURE VARIATIONS

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STABLE. EASY TO OPERATE. WATER COOLED FOR HIGH TEMPERATURES. FREQUENCY RESPONSE 0 to 10,000 cps. PRESSURE RANGE 0 to OVER 20,000 psi.

THIS EQUIPMENT IS READILY ADAPTED TO NON-CONTACT SMALL DISPLACEMENT MEASUREMENTS OF MOVING BODIES FOR MEASURING STRAINS, VIBRATION AND OTHER OPERATING CHARACTERISTICS.



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Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE INDUSTRIES

Continued advances in general business activity are indicated. The *New York Times* index for the week ended Nov. 22 stands at 152.9, as against 148.4 for the preceding week and 142.6 a year ago.

Sales of department stores during the week ended Nov. 22, as reported by the Federal Reserve Board, equaled 394 per cent of the 1935-39 average, as compared with 380 in the week before. Sales were nine per cent above the corresponding distribution a year earlier, as against a preceding similar excess of 11 per cent. The total in 1947 so far reported is eight per cent greater than the comparable sum in 1946.

Electric power production increased slightly in the week ended Nov. 22. The output was 8.7 per cent above the corresponding amount in 1946, as compared with a like advance of 8.2 per cent shown for the preceding week.

Railway freight loadings during the same period totaled 902,672 cars, 2.8 per cent more than the figure for the week before and 11.9 per cent above the corresponding number recorded last year.

Crude oil production in the week ended Nov. 22 averaged 5,275,300 barrels daily, or 18,200 barrels more than the preceding average and 465,650 barrels above the comparable output in 1946.

Production of bituminous coal and lignite during the week ended Nov. 22 is estimated at 12,900,000 net tons, 300,000 more than the output in the week before. The total production in 1947 so far reported is 13.3 per cent above the corresponding quantity in 1946.

Civil engineering construction volume reported for the week ended Nov. 27, according to *Engineering News-Record*, is \$116,802,000, or 16 per cent more than the preceding weekly figure and 259 per cent above the comparable sum in 1946. The total recorded for 48 weeks of this year is seven per cent more than the corresponding amount in 1946. Private construction is 0.5 per cent below that a year ago, but public construction has increased by 18 per cent.

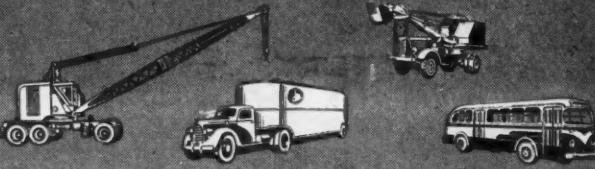
The wholesale price index of the Bureau of Labor Statistics for the week ended Nov. 22 is 159.2 per cent of the 1926 average, as compared with 158.5 for the preceding week and 137.3 a year ago.

Member bank reserve balances increased \$53 million during the week ended Nov. 26. Underlying changes thus reflected include a decrease of \$107 million in Reserve bank credit and a reduction of \$246 million in Treasury deposits with Federal Reserve banks, accompanied by an advance of \$130 million in money in circulation.

Total loans and investments of reporting member banks decreased \$13 million during the week ended Nov. 19. An increase of \$60 million in commercial, industrial and agricultural loans was recorded. The sum of these business loans, \$14,212 million, shows a net increase of \$2969 million in 12 months.

9 GOOD REASONS

for using VICKERS Hydraulic POWER STEERING



1 FINGER-TIP STEERING Finger pressure steers the heaviest vehicle equipped with Vickers Hydraulic Steering. Short, quick, effortless turns ease the job of parking, backing, loading and maneuvering in city traffic. On the open road there is no lag or road wander.

2 HEAVIER FRONT WHEEL LOADING Many steering difficulties resulting from heavy front wheel loading are overcome by Vickers Hydraulic Power Steering. It provides light, easy steering with heaviest front wheel loading.

3 LOWER STEERING RATIOS Present high steering ratios can be lowered substantially with Vickers Hydraulic Power Steering.

4 LESS DRIVER FATIGUE The Vickers Hydraulic Power Steering Unit takes all the steering strain—the driver has none. Anxiety about unsafe tires and hazardous road conditions is relieved.

5 LIGHTER CONSTRUCTION An over-all weight reduction can be made in the construction of steering gears, housings and columns since all stress and shock are borne by the booster unit and vehicle frame.

6 GREATER SAFETY Blowouts, soft shoulders, ruts, cross winds, road obstructions or sudden stops—none affect steering. In event of engine failure or damage to the hydraulic system, steering automatically reverts to direct mechanical action.

7 SHOCKLESS On the road or off the road, the driver feels no road shock or wheel fight.

8 LOWER COST Simplified installation and lowered manufacturing costs due to increased production make the price per unit lower now than ever before.

9 ADAPTABLE Only minor alterations needed to apply Vickers Hydraulic Power Steering to new or existing vehicle designs.

Vickers Hydraulic Power Steering has been in successful use for more than 16 years. The redesigned unit with integral relief valve has had more than a year of testing on heavy buses and trucks under most severe operating conditions.

Write for Bulletin 47-30 for full information.

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ST. LOUIS • TULSA • WASHINGTON • WORCESTER

ENGINEERS AND BUILDERS OF OIL HYDRAULIC
EQUIPMENT SINCE 1921

General News

(Continued from page 23)

Timken Roller Builds New Rock Bit Plant in Colorado

Originally scheduled to be built by the Colorado Springs Chamber of Commerce, all construction has been taken over on the new \$150,000 rock bit plant at Colorado Springs, Colo., by the Timken Roller Bearing Co. which has bought the eight-acre site. A daily output of almost 10,000 rock bits has been initially scheduled.

Annual Wright Lecture on Low-Drag & Suction Airfoils

To be held Dec. 17 in Washington, D. C., under the sponsorship of the Institute of Aeronautical Sciences, the Annual Wright Brothers Lecture will be "Low-Drag and Suction Airfoils," by Dr. Sydney Goldstein, University of Manchester, England.

Announce Publication of 1947 Edition of "Marinas"

The publication of the 1947 edition of their book, "Marinas—Recom-

mendations for Design, Construction and Maintenance," written by Charles A. Chaney, has been announced by the National Association of Engine and Boat Manufacturers. The basic volume of the same title was published in 1939 as an aid to engineers, communities, and private groups who were planning a marina, and were facing difficulties because of a lack of boat basin construction experience.

Result of British Flat Tax Is Larger Engines for Cars

As a result of the flat rate tax of £10, which takes effect on January 1, it has been decided to equip the British Ford V-Eight chassis with the 219 cu in. engine in place of the 152 cu in. model. A similar move has been made by Austin, which will equip the Sheerline and Princess with a 244 cu in., six-cyl engine.

Boyd Becomes Consultant of GM Research Lab Staff

At his own request T. A. Boyd has been relieved of his duties as head of the Organic Chemistry Dept. of the GM Research Laboratories Div. The request was granted on Oct. 1, when Mr. Boyd became a consultant on the Research executive staff. He has been succeeded as head of Organic Chemistry by John M. Campbell, a staff chemist. Mr. Boyd has been with GM for more than 25 years. He was a co-inventor of Ethyl gasoline with the late Dr. Thomas Midgley, Jr. He is president of the American Society for Testing Materials.

Appoint Lenz Assistant To Pontiac General Manager

Arnold N. Lenz, until recently general manufacturing manager of GM's Chevrolet Motor Div. in Cleveland, has been made assistant to H. J. Klingler, Pontiac general manager. Lenz started with Buick in 1916 and in his 31 years in the industry has been responsible for many standard practices now in use. He joined Chevrolet in 1919.

Wayne Foundry Using Short-Run Stamping Methods

By adapting the short-run stamping techniques developed by the airplane industry during the war, the Wayne Foundry Company, Detroit, Mich., is now making stampings by

(Turn to page 93, please)

KEEPING ABREAST OF POWER PROGRESS

The new **TOURNADOZER** is protected against dust by a **DONALDSON AIR CLEANER**



Dust and 'dozers go together, which makes dust protection for the prime mover essential. On the new Tournadozers, as on most heavy-duty equipment, Donaldson Air Cleaners are given the job of providing dust-free air for the engine, in this case a Buda 6DCS-844.

New power-driven equipment such as the Tournadozer presents new dust protection problems. Donaldson research, engineering and testing facilities are at the disposal of all manufacturers in solving these problems.

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AIR CLEANERS

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STRIES



Michigan WELDED STEEL TUBING

The Modern Electric Resistance Welded Steel Tube

ROUND

$\frac{1}{4}''$ to 4" O.D. 9 to 22 gauge
SQUARE - RECTANGULAR

$\frac{1}{4}''$ to 2" 20 gauge
1" to 2 $\frac{1}{4}$ " 14, 16, 18 gauge

Michigan Welded Steel Tubing is available in sizes and shapes that make it readily usable in the production of a wide variety of parts.

Whether you form and machine the parts in your plant or order them prefabricated by Michigan, you will find this tubing exceptionally uniform in structure and adapted to reworking by any production process.

Michigan welded tubing can be:



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Engineering advice and technical help in the selection of tubing best suited to your needs. Address inquiries to:

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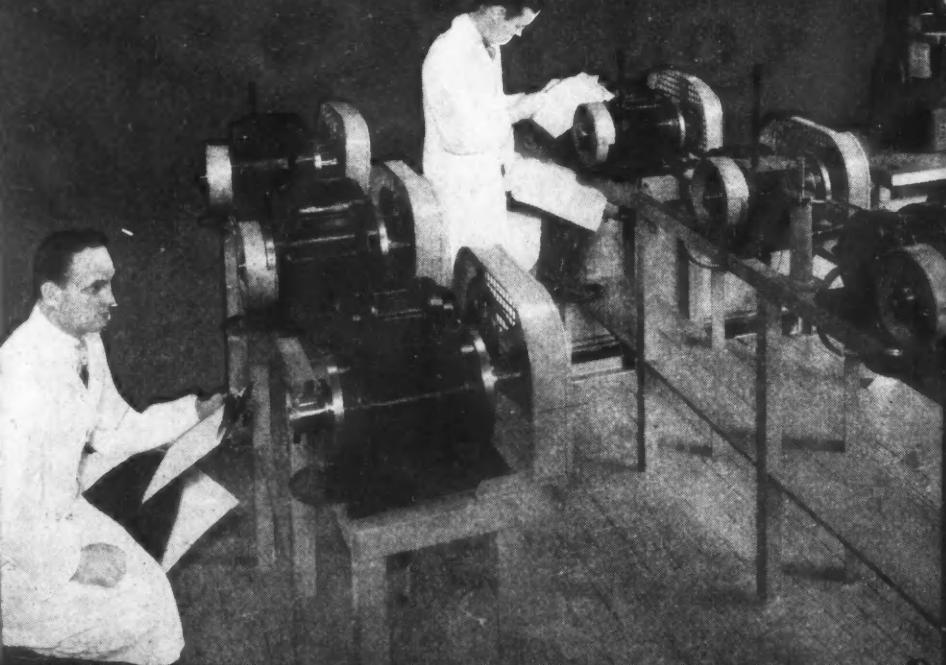
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THERE ARE A LOT OF \$64 QUESTIONS IN THE SELECTION AND APPLICATION OF OIL SEALS







General News

(Continued from page 90)

that method. At present, the company is engaged in producing the first 50 sets of body panel stampings for the Tucker car as a sub-contractor to Hayes Mfg. Co. Facilities for pattern and model making coupled with nonferrous foundry equipment, permit the making of dies of Kirksite and punches of lead or Kirksite.

For producing stampings in any size and form required for motor car or truck applications, they adapt a number of techniques singly or in combination. In one, there is a battery of three Chambersburg Cecostamp hammers which can be used for a variety of stamping operations. Supplementing these, there is a 300-ton capacity Ercostitcher press of the kind used by the airplane industry during the war. Depending on the nature of the stamping, it can be crowned or drawn to form in the stretcher press, then given a restrike in a Cecostamp. Or the entire operation may be completed in the Cecostamp.

Where fine formation and detail are desired the stamping is given a series of metal finishing operations which may include vibrating hammer forming and hand dinging by skilled operators. The stampings are then ground and polished and smoothed and filled with solder if necessary. In making stampings on Cecostamps, they follow aircraft practice by using the Guerin rubber mat technique.

Obituary

Thomas W. Warner

Thomas W. Warner, 73, founder of the Warner Gear Co., later merged with Borg-Warner Corp., and of the Warner Mfg. Co., later merged with General Motors Corp., and formerly a GM director, died on Dec. 2 in Pasadena, Calif., following a brief illness.

Alfred J. Marchev

Alfred J. Marchev, 51, president, Aircraft Screw Products Co., Inc., Long Island City, N. Y., and former president and chairman of the board, Republic Aviation Corp., died suddenly on Nov. 28, in Garden City, N. Y.

Francis H. Fenn

Francis H. Fenn, 49, president and general manager, American Bantam Car Co., Butler, Pa., died recently in Pittsburgh.

(Turn to page 94, please)

A Flip of the Finger

-PLUS AN S.S.WHITE
FLEXIBLE SHAFT

...operates the selector valve
in the Mack Mono-Shift

Photos and data
courtesy of
Mack Motor Truck Corp.,
New York, N. Y.



The Mack Mono-Shift duplex 10-speed transmission, reduces truck gear shifting to simplest terms. It provides single-lever shifting of all 10 speeds, with pre-selection of the compound ratios through a finger-operated "flipper" on the shift lever. A turn of this flipper sets the selector valve that controls the air and vacuum supply to the power cylinder which actuates the shift.

An S.S.White flexible shaft (arrow) extending down inside the lever transmits the movement of the flipper to the valve operating mechanism, readily conforming to the various positions of the lever. Can you think of any other way to do this that would be as simple? Smooth, positive and dependable in operation and readily adapted, S.S.White flexible shafts are the answer to a wide variety of remote control problems.

FREE TO ENGINEERS — THIS FLEXIBLE SHAFT HANDBOOK

260 pages of information and technical data about flexible shafts and how to select and apply them for specific requirements. Copy sent free, if you write for it on your business letterhead and mention your position.



S.S.WHITE INDUSTRIAL DIVISION

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FLEXIBLE SHAFTS • FLEXIBLE SHAFT TOOLS • AIRCRAFT ACCESSORIES
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One of America's AAA Industrial Enterprises

PACIFIC COAST REPRESENTATIVE—F. W. STEWART MFG. CORP.
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**ARE
Designed
FOR
PRODUCTION**

The line of Detrex standard solvent vapor degreasers contains units capable of fitting into any production line.

The 1 DC-750, for example, is a conveyorized one-dip concentrator which has been designed to meet the degreasing requirements of screw machine shops.

**HERE'S WHY THE 1 DC-750
IS FAVORED FOR THIS JOB**

1. Its overall height overcomes low ceiling limitations; it occupies less than 75 square feet of floor space.
2. Rotary and flat baskets can both be used, or rotary alone—depending upon production requirements.
3. Each basket is stopped at predetermined stations by a solenoid brake—facilitating loading and unloading.

Yes, most standard degreasers are stocked for prompt delivery. Call the Detrex field representative nearest you for complete information.



DETREX Corporation

DETROIT 32, MICHIGAN

E-172

ASSEMBLY

Hot Dip GALVANIZING

MODERN TOOL ROOM

AVAILABLE PRESS CAPACITY
20 to 90 Tons 10 ft. Press Brake
10 ft. Shear

**WELDING
PLATING**



General News

(Continued from page 93)

Car and Truck Exports Rise Sharply in August

Although August foreign trade registered a slight slump, car and truck exports rose sharply for the month, it is revealed in the latest Commerce Dept. report. Exports of trucks and buses aggregated 24,423 vehicles for the month, an increase of more than 8000 over July; passenger car shipments totalled 23,454,300 above the July figure. Shipments abroad of automotive parts for replacement and maintenance purposes were valued at \$14 million, while parts for assembly purposes were listed at \$6.9 million.



Inspection fixture in the Bendix production department showing arrangement for testing of self-regulating a-c 35-watt generators which were described in the Aug. 15 issue of AUTOMOTIVE INDUSTRIES on page 60. The generator is mounted as shown in the lower right hand corner of the panel with the drive disk in contact with a motor driven flywheel.

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**THE PIONEER
MANUFACTURER of
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CHUCKING
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Wilco Electric Contacts and Contact Assemblies

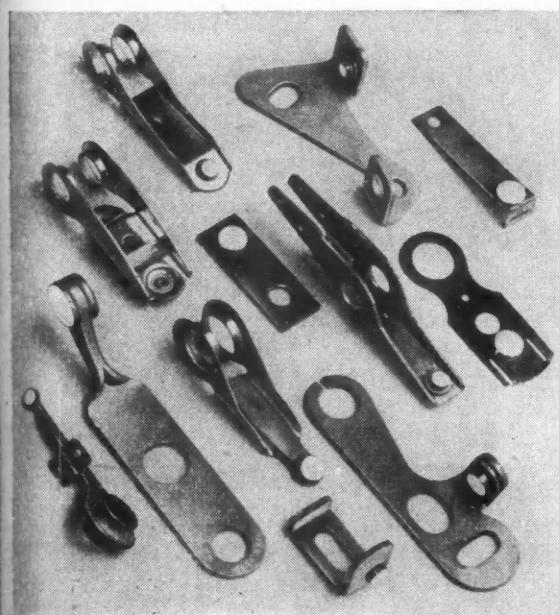
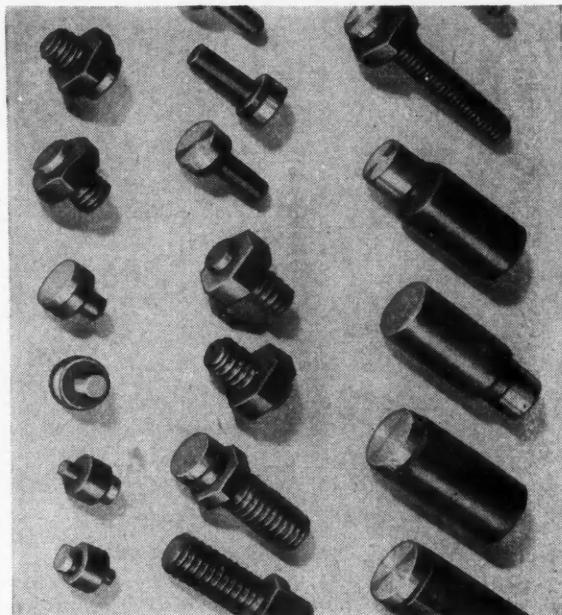
Precision-Built for Precision Performance

TO MEET YOUR MOST EXACTING REQUIREMENTS . . .

WILCO produces contacts and contact assemblies in gold, silver, platinum, tungsten and in alloys and combinations of these. All reflect WILCO's 33 years experience and many thousands of applications.

WILCO Tungsten Contacts . . .

are made of 99.95% pure tungsten, thus assuring the highest melting point of any contact material . . . a hard, bright, oxidation-resisting finish, high density, maximum life, low vapor pressure at elevated temperatures, high strength and arc-resisting properties. WILCO SINTERED METAL CONTACTS incorporate tungsten of the same high purity. WILCO COMPOSITE CONTACTS, faced with fine silver or silver alloy make possible considerable savings. Our sales engineers will be glad to explain details.



WILCO Contact Assemblies . . .

Wilco Tungsten and other Contact Assemblies are assembled to thermostatic bimetal, steel, beryllium, copper and other non-ferrous metal springs, blades, brackets, arms and screws (brazed, riveted, welded, spun) . . . conform in size, shape and material to manufacturers' individual requirements . . . combine the superfine quality of WILCO contact materials and WILCO thermostatic bimetals to meet the highest performance standards.

CONSULT OUR ENGINEERING DEPARTMENT—A representative of the WILCO Sales and Engineering Department will gladly help develop the proper application of WILCO materials to your products.

WILCO PRODUCTS INCLUDE:

THERMOSTATIC BIMETAL—All temperature ranges, deflection rates and electrical resistivities.

CONTACTS—Silver—Platinum—Tungsten—Alloys—Sintered Powder Metal.

SILVER CLAD STEEL

JACKETED WIRE—Silver on Steel, Copper, Invar or other combinations requested.

ROLLED GOLD PLATE AND WIRE

M-SPAN C* New Constant Modulus Alloy

SPECIAL MATERIALS *Reg. Trade Mark The International Nickel Co., Inc.

THE H. A. WILSON COMPANY

105 CHESTNUT STREET, NEWARK 5, NEW JERSEY
Branch Offices: Chicago, Detroit, Los Angeles, Providence



SPESIALISTS FOR 33 YEARS IN THE MANUFACTURE OF THERMOSTATICS • ELECTRICAL CONTACTS • PRECIOUS METAL BIMETALLIC PRODUCTS AND SPECIAL MATERIALS

This is HY-POWER



THE STANDARD HY-POWER UNIT
can be mounted anywhere
on chassis

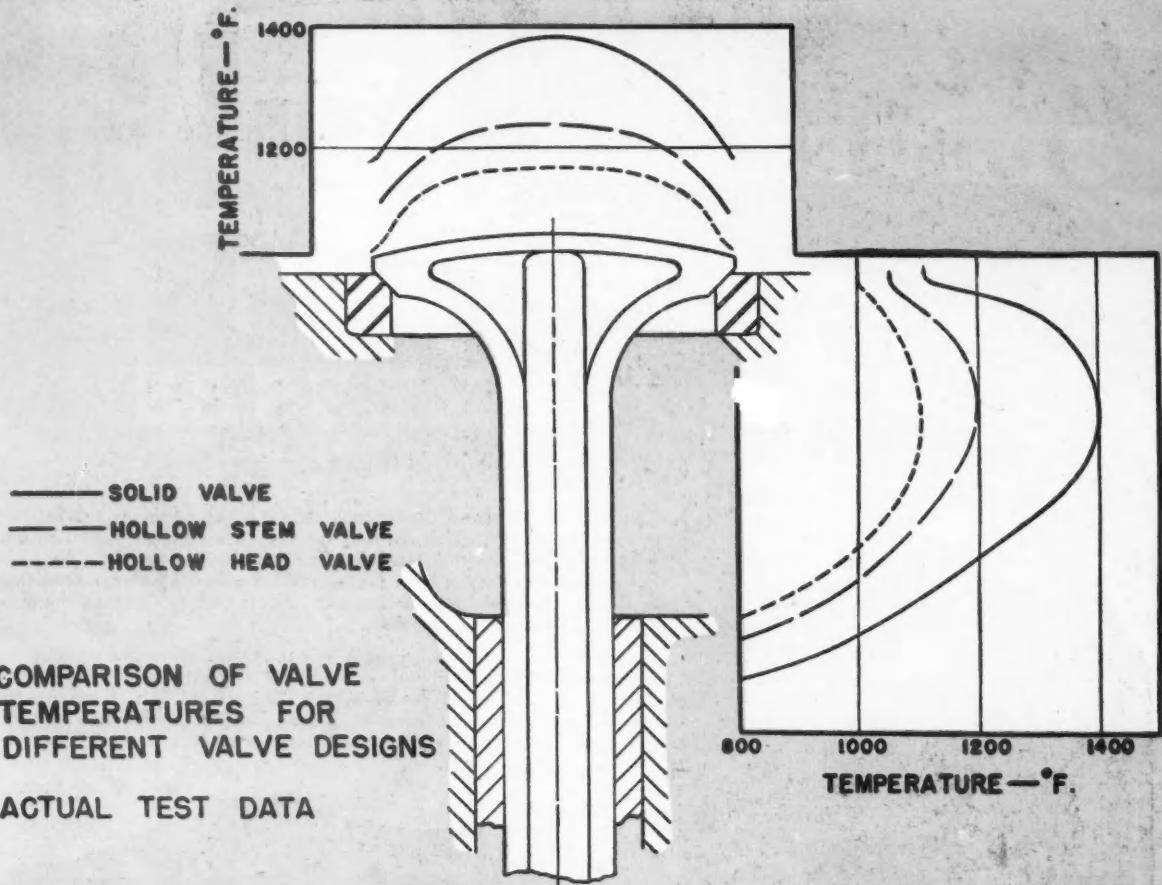
The Self-Contained, Efficient Power Brake That Assures Better Control for All Loads on All Roads

The super power and instant, smooth action of HY-POWER makes the brakes on any size truck safer and more efficient on any route they travel. HY-POWER combines in a single, completely enclosed unit all the advantages — proved by long service — of the Midland vacuum diaphragm chamber, hydraulic vacuum valve and hydraulic slave cylinder. This simplified unit has established a new standard of efficiency in truck power brakes. Write, wire or phone for complete information.

THE MIDLAND STEEL PRODUCTS CO. • 6660 MT. ELLIOTT AVE., DETROIT 11, MICH.

Export Dept: 38 Pearl St., New York, N. Y.

MIDLAND POWER BRAKES



THE Thompson SODIUM-COOLED AUTOMOTIVE VALVE



Above are shown some of the many variations in internal design and sodium content that adapt Thompson Sodium-Cooled valves to heat characteristics of different engines. Hard alloy seats and stem tips are optional.

Designed to fit the thermal characteristics of your engines

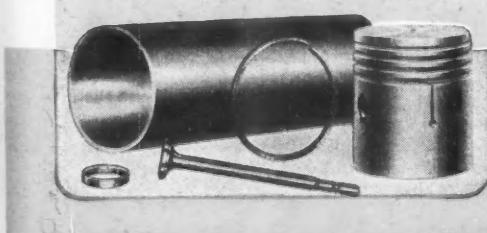
THE NEW THOMPSON SODIUM-COOLED VALVE features highest flexibility of design. Contours and areas of the cavity in head and stem can be varied to fit the specific heat characteristics of different engines.

It is setting new standards of valve ruggedness and permits higher compression ratios for fuel economy and improved engine performance.

It can now be manufactured at costs which will make it widely used as original equipment in automotive, marine and industrial engines.

We will be glad to work with your engineers to determine the most efficient design for your engines.

Thompson improvements in precision parts engineering include Steel-Belted Pistons, U-Flex Oil Control Rings, Cylinder Sleeves, Valve Seat Inserts, Sodium-Cooled Valves.



Thompson Products

CLEVELAND • DETROIT • LOS ANGELES • ST. CATHARINES, CANADA

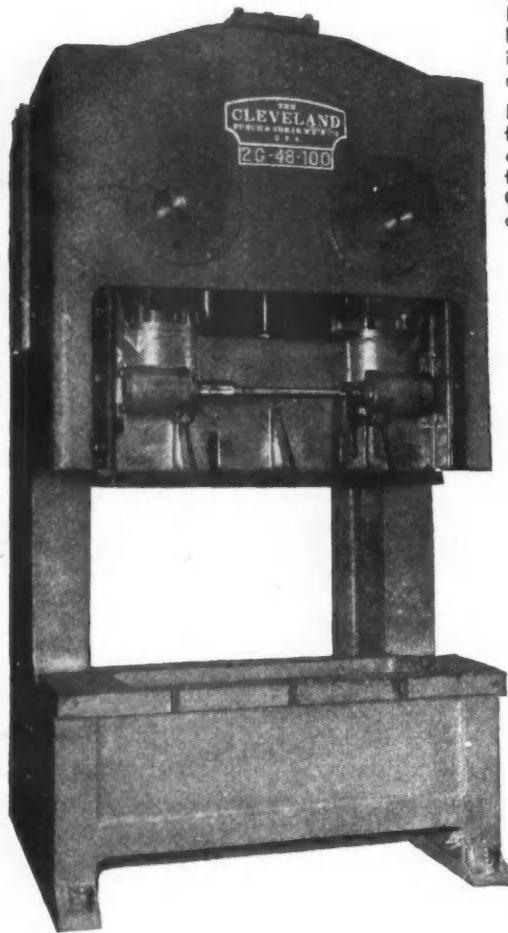
CLEVELAND

OPEN BACK GAP

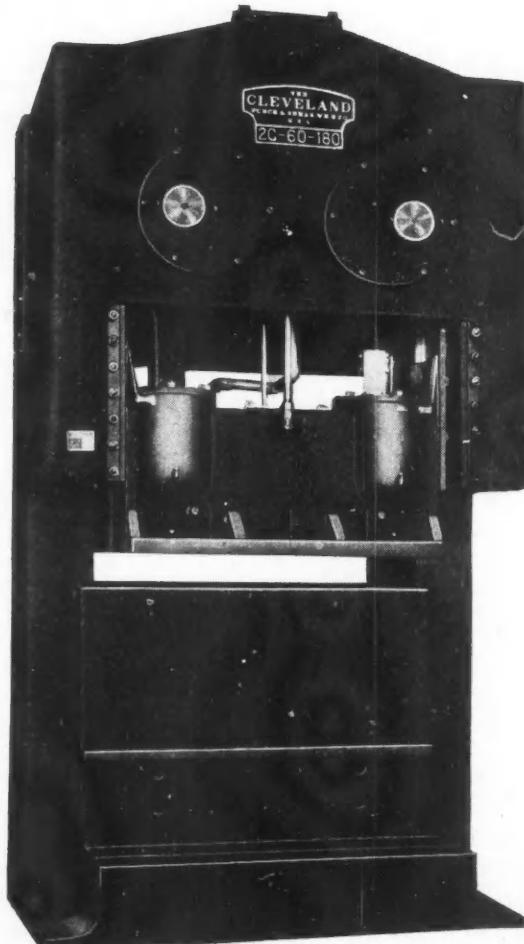
PRESSES

This line of Cleveland Open Back Gap Presses combines the Modern stream line design, which not only assures more efficient operation and longer life but also reduces floor space to a minimum, with the over-hanging gap and open back features which afford greater convenience in the handling of large or irregular sheets and for feeding material right and left across the dies.

Built in a wide range of sizes and capacities, these Presses can be furnished with standard bed, or with the bed cut back to accommodate various tables, as shown by the illustrations. This is but one of the fourteen different types of Mechanical Power Presses built by Cleveland for efficiency of operation and economy in the production of Pressed Metal parts.



Cleveland Two Point Gap Press, Twin Drive, equipped with Air Friction Clutch, air counter-balance to slide, stroke 8", adjustment 4", shut height 24", R.P.M. 35, capacity 100 tons.



Cleveland Two Point Gap Press, flush front, equipped with air friction clutch and separate air brake on flywheel. Stroke 12", adjustment 4", shut height 54", R.P.M. 35, capacity 180 tons.

CLEVELAND

THE CLEVELAND PUNCH & SHEAR WORKS CO.

CLEVELAND 14, OHIO

NEW YORK • CHICAGO • DETROIT • PHILADELPHIA • PITTSBURGH



He has to take chances
... YOU CAN PLAY SAFE!

American Hammered Porous Chrome* Piston Rings assure peak engine efficiency for a considerably longer period. These amazing rings have established spectacular performance records. Now they embody another new, exclusive American Hammered development: F-88 Hi-Strength Iron, which assures even greater wear resistance, higher impact strength, increased elasticity.

A combination of Porous Chrome compression rings with one of the several types of American Hammered oil control rings will give maximum piston ring efficiency and long life. Our engineers are prepared to help you in selecting your ring combination. Koppers Company, Inc., Piston Ring Division, Box 626, Baltimore 3, Maryland.

*VAN DER HORST PROCESS



American Hammered Piston Rings

IN EVERY SIZE - OF EVERY TYPE - FOR EVERY PURPOSE

skilled springmakers..
AND practical,
experienced engineers,
SPECIALISTS
in spring design
and manufacture

At Accurate



It takes people to make springs. Ours are specialized, highly trained, long-experienced people—well qualified to give you the finest in spring craftsmanship.

Q Our engineers too, are an important reason why you'll like Accurate Spring Service. They're old hands at spring-making...they've developed manufacturing systems and procedures that enable us to handle your jobs with the greatest speed and efficiency. These Accurate engineers are at your service on spring design problems. You will benefit from their practical assistance in designing exactly the right spring for your application.
Q Why not try Accurate on your next job.

ACCURATE SPRING MFG. CO.
3810 W. Lake Street

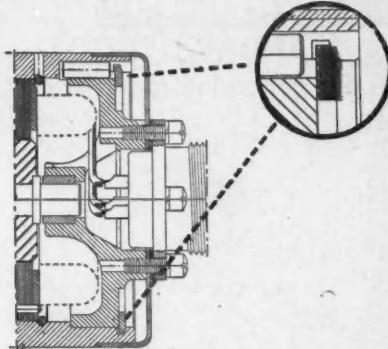
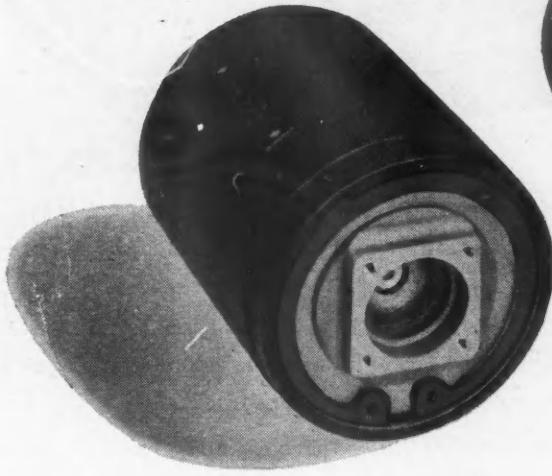
Chicago 24, Illinois

Send for your copy of the new Accurate Spring Handbook. It's full of data and formulae which you will find useful. No obligation of course.

SPRINGS • WIREFORMS • STAMPINGS

Accurate
Springs

Truarc Beveled Ring takes up end-play, eliminates shims, saves 20 minutes' assembly time



TACHOMETER GENERATOR — Kollsman Instrument Division, the Square D Company—showing Waldes Truarc Beveled Retaining Ring.

When installed in a groove with a corresponding bevel, the tapered edge of the Beveled ring acts like a wedge and rigidly bridges end-play. End-play can also be taken up resiliently by another type Truarc ring—the Bowed.

Wherever you use machined shoulders, nuts, bolts, snap rings, cotter pins—there's a Truarc ring that does a better job of holding parts together. All Truarc rings are precision engineered, easy to assemble and dis-assemble, always circular to give a never-failing grip. They can be used over and over again.

See what can be done for your product: send a drawing to Waldes Truarc Technical Service Engineers for individual attention without obligation.

One Waldes Truarc Beveled Retaining Ring gives Five big advantages:

- Secures the cover with its connecting parts in the housing against strong pressure, heavy vibration
- Absorbs accumulated tolerances up to .010 (ring diameter is 1.9375)
- Eliminates shims, saves material and weight
- Saves 20 minutes' assembly time
- Simplifies field maintenance by facilitating quick dis-assembly, re-assembly

*Mail this coupon today for your copy of
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Please send booklet, "New Development In Retaining Rings" to:

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WALDES TRUARC RETAINING RINGS ARE PROTECTED BY U. S. PATS. 2,302,948; 2,026,454; 2,416,882 AND OTHER PATS. PEND.

Now! MORE THAN 600 CARBOLOY® STANDARDS

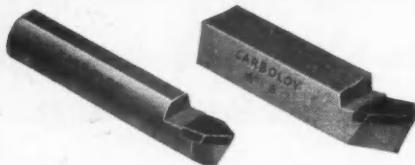
CEMENTED CARBIDE

... OVER 80
STANDARD TOOLS!
for general purpose use.



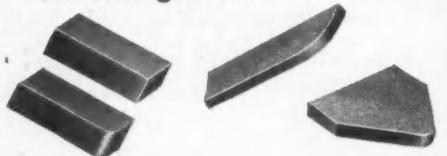
One of 11 standard styles

... OVER 60
STANDARD BORING TOOLS!



two of the 7 styles available

... OVER 180
STANDARD BLANKS!
for cutting tools.



A few of the many shapes available

... OVER 300
**STANDARD WEAR—
RESISTANT BLANKS!**



typical examples of available shapes

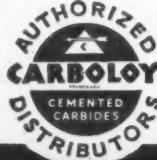
... FOR MAXIMUM RESULTS
WITH CARBIDE TOOLING

Looking for ways to increase production . . . to reduce manufacturing costs . . . to meet and beat Today's competition.

HERE'S THE ANSWER . . . get greater carbide tool effectiveness . . . with the greater advantages you get in low-cost Carboloy "Standards."

More than 600 Carboloy "Standards" . . . cutting tools and blanks . . . ready for instant use . . . are "on-the-shelf" . . . stocked for speedy delivery by local distributors in 74 cities coast-to-coast. Why not look into the unusual benefits in Carboloy Cemented Carbides . . . get maximum results through greater carbide tool advantages.

Have you seen the New 1948 Carboloy Tool Catalog —just published? This 64-page illustrated catalog . . . most comprehensive in the cemented carbide industry . . . is literally packed with cost-cutting "Standards" and their applications . . . a veritable abundance of Carboloy Cemented Carbides to handle 60%—80% of your machining needs. Send for your FREE copy TODAY! Carboloy Company, Inc. 11151 E. 8 Mile Street, Detroit 32, Michigan.



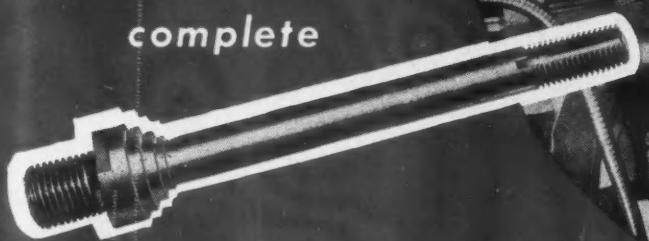
Standards are
stocked in
74 cities
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CARBOLOY

CEMENTED ® CARBIDES

**13
OPERATIONS
15
SECONDS**

complete



Second operations cost men, money and machines—often needless. You can't use old-fashioned, high-wheel Safety Bike methods to make a profit on parts for today's racer bikes.



Modern Acme-Gridleys will produce these racer parts—and any other metal parts, too—at racer speeds. Flexibility of tooling and the broad use of ingenious attachments eliminate many second operations.

You owe it to your profit and loss statement to investigate how Acme-Gridley 4, 6 and 8 spindle bar and chucking machines can save you time, space, manpower and machining costs by stepping up your parts production. May we give you the facts?

**PROFITABLE PRODUCTION—
THE ACME-GRIDLEY WAY**

PART—Bicycle Pedal Shaft.
SIZE— $\frac{3}{4}$ " dia. x $4\frac{5}{8}$ "

MATERIAL—SAE 1112 Steel
MACHINE—Acme-Gridley 1 $\frac{1}{4}$ " RA-6 Bar Automatic.

OPERATIONS—13, including shave large thread diameter and roll thread, mill flats on large diameter, die thread and mill keyway on small end.

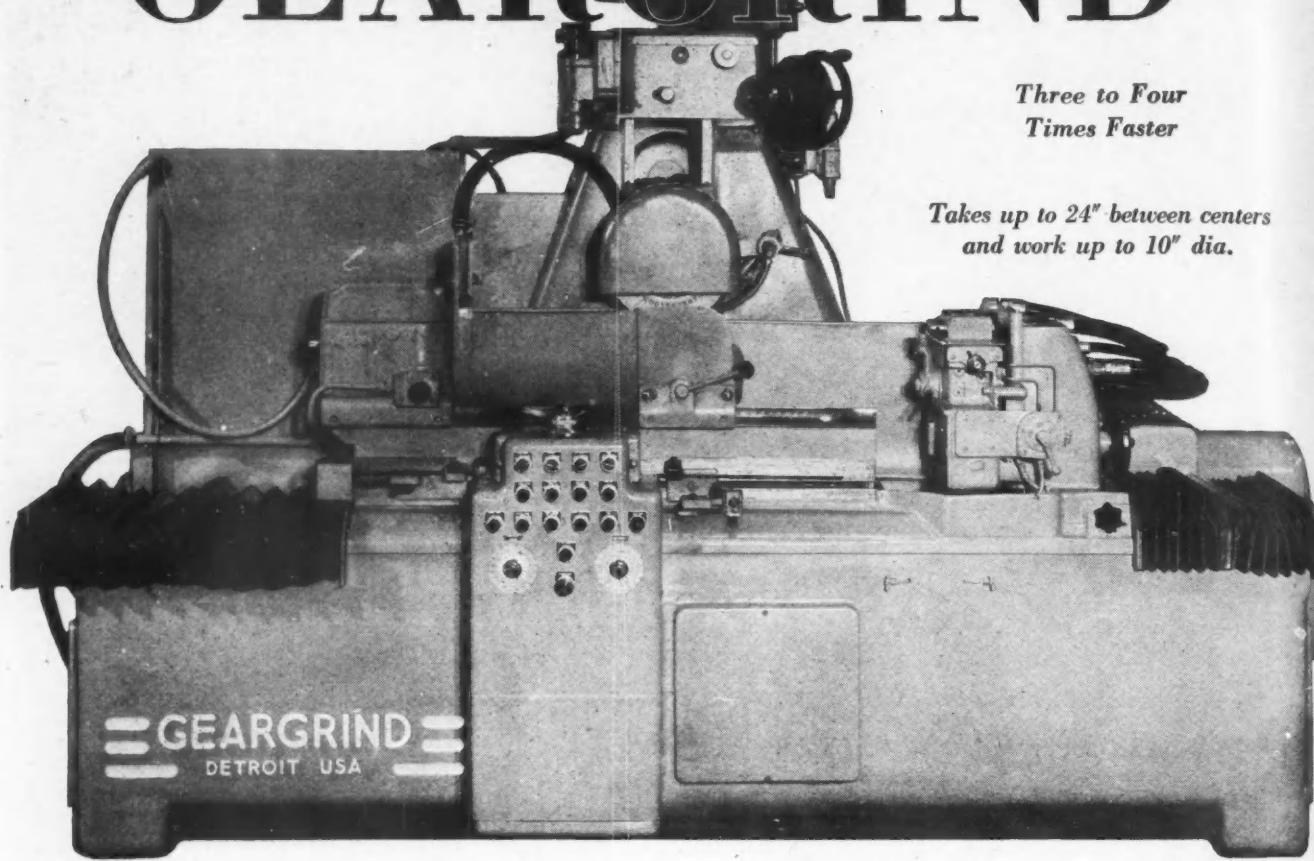
MACHINE TIME—15 seconds, or a production rate of 240 per hour.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

**Acme-Gridley Bar and Chucking Automatics:
1-4-6 and 8 Spindle • Hydraulic Thread
Rolling Machines • Automatic Threading Dies
and Taps • The Chronolog-Limit, Motor Starter
and Control Station Switches • Solenoids
Centrifuges • Contract Manufacturing**

The NEW GEARGRIND



With Automatic Wheel Feed

Work reciprocates past the grinding wheel, using a fast, short stroke. At each reversal point the grinding wheel feeds down, automatically.

Grinding continues on one tooth space until a "rough size" is reached, after which the work is indexed and the grinding wheel head re-set.

After a pre-set number of teeth have been "roughed out" the dresser moves into

position for trueing the grinding wheel.

All these operations are automatic, and adjustments for number of teeth ground before dressing, total down feed and number of cuts is readily variable over a wide range.

Grinding by this new GEARGRIND method is done in $\frac{1}{3}$ to $\frac{1}{4}$ of the time required by any previous gear grinding machine of comparable capacity.

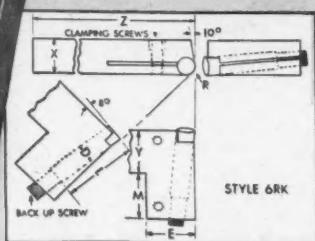
WRITE for complete information.



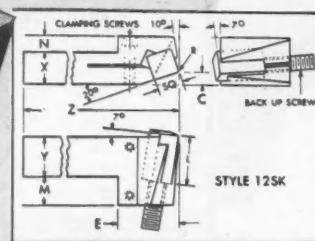
Another KENNAMETAL Development

KENNAMATIC Tools

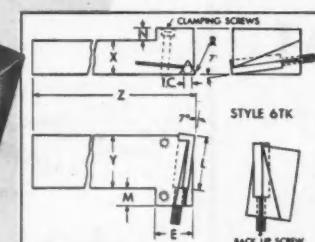
having CLAMPED-IN, INDEXABLE
Solid KENNAMETAL Inserts



Style 6RK (and opposite hand 3RK) have cylindrical inserts that can be indexed several times, then turned end for end and used for a second cycle of cutting before regrinding. When both ends become dull, they are reground, and are then ready for another double cycle of cutting. The inserts can be reground many times.



Style 12SK (and opposite hand 11SK) have square inserts, indexable four times on each end. Ends can be reground many times and each double-end regrind provides eight resharpened cutting edges.



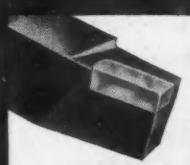
Style 6TK (and opposite hand 3TK) have triangular inserts, indexable three times on each end. Ends can be reground many times—and each double-end regrind provides six resharpened cutting edges.



Serrated Milling Cutter Blades



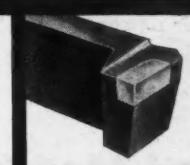
STYLE VG



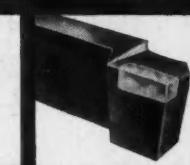
STYLE 12



STYLE 15



STYLE 10



STYLE 2

Solid, Mechanically-Held Kennametal Inserts

Inserts are mechanically-held, vertically—best use is made of high compressive strength of Kennametal (up to 800,000 PSI); brazing strains are eliminated.

Indexable Cutting Edges

Can be indexed 6 to 12 times before regrinding. Indexing is a simple operation, and does not require changing tool holder.

Replaceable Inserts

Few standard sizes can be used in a variety of tools and jobs—simplifies tool control; reduces toolroom stocks.

Simplified Regrinding

Resharpening merely requires squaring off both ends of insert, and grinding chip breaker if required—reduces load and confusion in grinding room.

Permanent Setting

Insert can be indexed or changed without changing tool holder setting—less set-up and machine down time.

The overall result of Kennamatic tooling is that higher production rates can be reached, and maintained, at much less cost. Let our engineers suggest suitable applications.



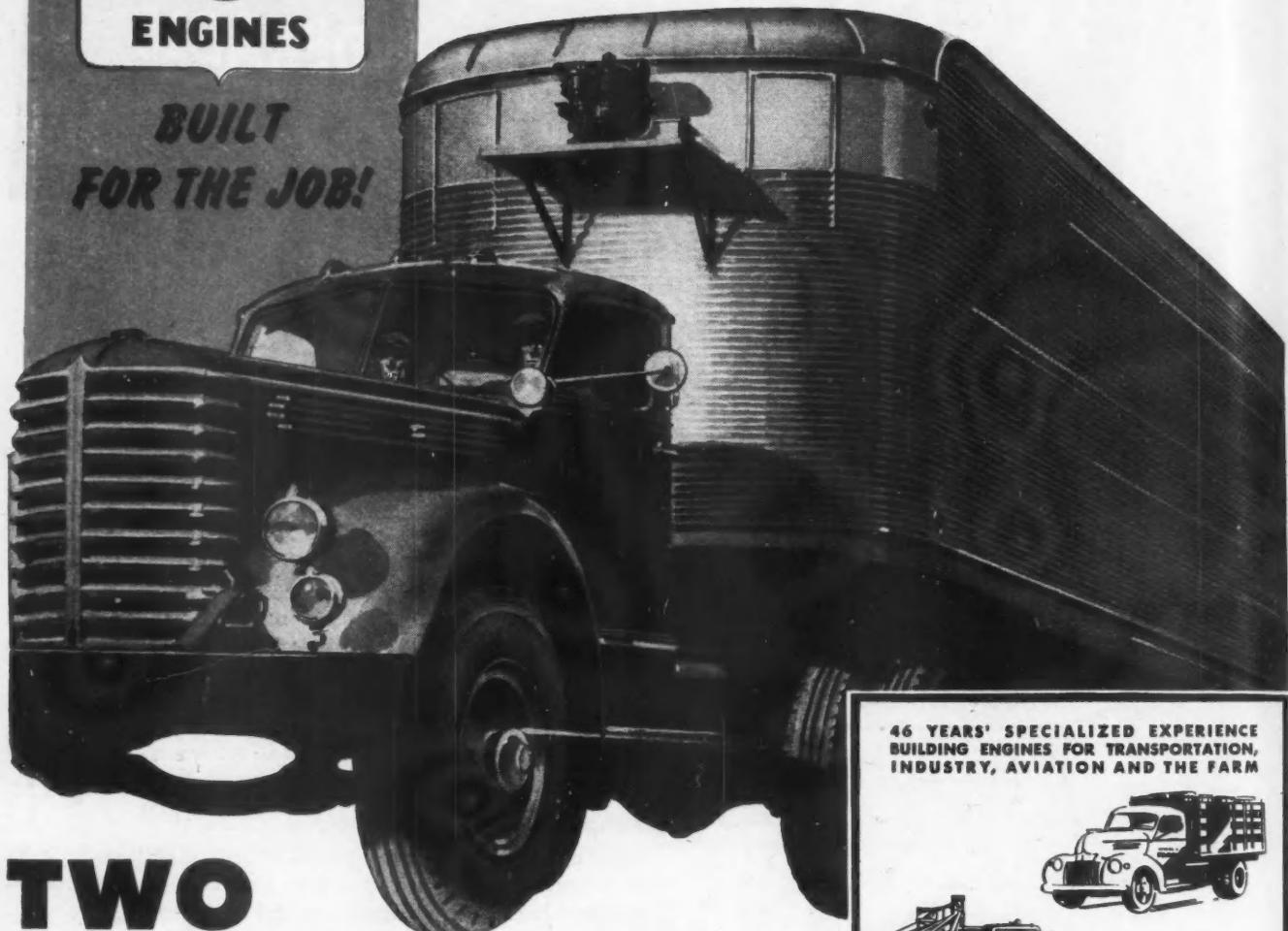
KENNAMETAL Inc., LATROBE, PA.

CONTINENTAL



ENGINES

**BUILT
FOR THE JOB!**



TWO ENGINES . . . both Continental RED SEAL

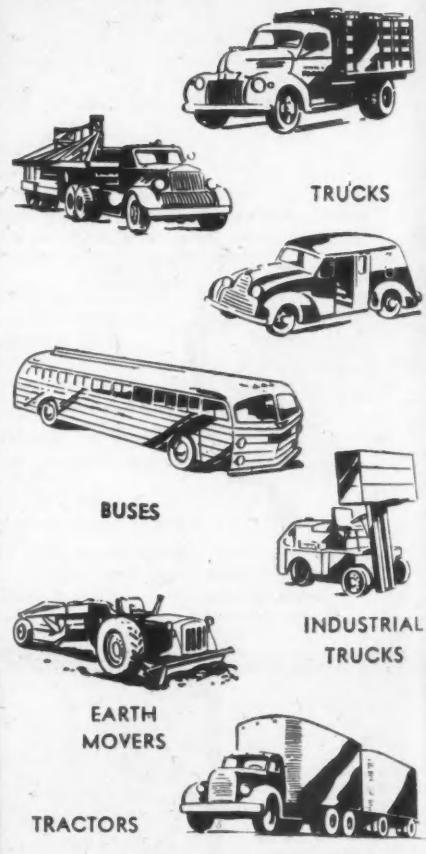
The $1\frac{1}{2}$ h.p. Red Seal AA-7 keeps perishables chilled while the big Red Seal truck engine hauls them quickly, economically to market.

Continental builds them, big *and* little. Continental engineers them to meet the varying fuel and service requirements of any area — any application. Continental matches them to the job they have to do.

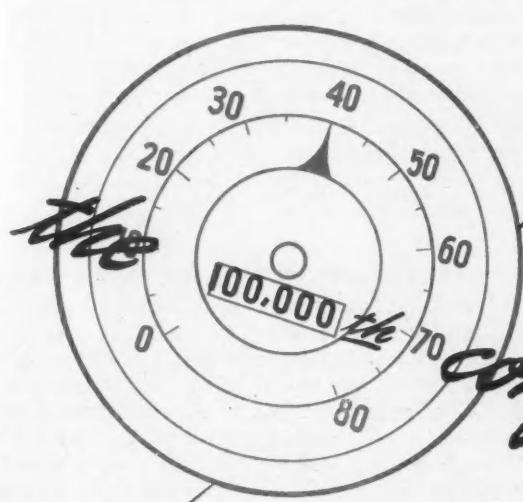
Continents are specialized engines, so no matter what the equipment you operate — or build — one of them will do a better job at lower cost. From school buses to transcontinentals, from industrial trucks to huge tractors — and for passenger cars, as well — count on Continental to have the engines best suited to the job — and nationwide parts and service network to back them up.

Continental Motors Corporation
MUSKEGON, MICHIGAN

46 YEARS' SPECIALIZED EXPERIENCE
BUILDING ENGINES FOR TRANSPORTATION,
INDUSTRY, AVIATION AND THE FARM



The first mile shows it...



confirms it...

the best brake is **AIR**

Within the first few miles your drivers will tell you that nothing can beat the efficiency and security that Air Brakes add to a vehicle. The extra stopping power lets your vehicles handle bigger payloads, cuts the strain on the driver, and improves scheduling. And on top of all that, operating costs go *down* over the miles. Time on the road is higher, time in the shop is minimized. Ask any experienced operator—he'll tell you that every mile ticked off confirms the wisdom of installing Air Brakes—genuine Bendix-Westinghouse Air Brakes.

BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE COMPANY, ELYRIA, OHIO



the best **AIR** brake is *Bendix-Westinghouse*

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Milling Methods
Like These with..
SUNDSTRAND
"Engineered
Production"



SUNDSTRAND
MACHINE TOOL COMPANY

2571 Eleventh St. • Rockford, Ill., U.S.A.

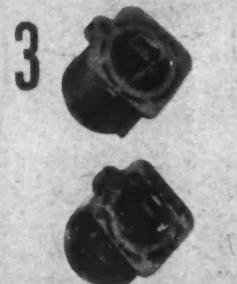
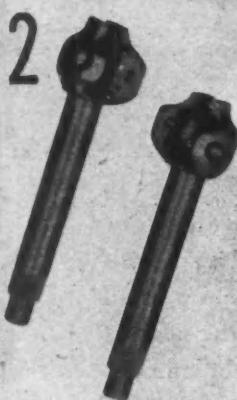
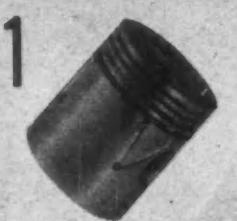
RIGIDMILS • AUTOMATIC LATHES • SPECIAL MILLING AND TURNING MACHINES

Basically, there are two approaches to solving milling production problems, (1) obtaining standard machines, then trying to process parts over these machines as economically as possible, (2) designing the most profitable processing method, then obtaining machines to suit this method — standard or semi-standard machines, if possible, or entirely special machines, if necessary.

This latter method is Sundstrand "Engineered Production" . . . the most practical approach to economical milling. The following is a brief resume of the complete engineering and manufacturing service available from Sundstrand to meet all or any of your production milling requirements in small and medium size work.

These actual examples are presented to reveal one of each of the methods used in solving milling production problems. One of these methods may be the solution to your present problem.

MILLING 204 PISTONS PER HOUR WITH STANDARD RIGIDMIL This Sundstrand No. 00 standard Hydraulic Rigidmil is tooled to mill the expansion control slot in automotive pistons. It has a single horizontal spindle with speeds from 85 to 3600 rpm. The table is $7\frac{1}{2}$ " x 25" and has 8" of travel with a range of feeds from $\frac{1}{2}$ to 37 inches per minute. The table is provided with work holding fixtures and a standard two-way automatic cycle. Consequently the operator loads in one fixture while work is being performed in the other. Loading time is free making it possible to mill 204 pistons every hour.



STANDARD RIGIDMIL WITH SPECIAL HEAD MILLING INTERNAL SLOTS SIMULTANEOUSLY Opposite slots inside of these gear shafts are milled on this standard Sundstrand Rigidmil provided with a special head. Quills have power movement endwise to bring cutters in and out of cutting position. The spindle head is provided with vertical power movement in combination with table movement to provide a rectangular cycle operating in a vertical plane. A special 2 spindle head replaces standard head so that 2 parts can be milled simultaneously.

SPECIAL THREE HEAD RIGIDMIL MILLS, ROUGH AND FINISH BORES SIMULTANEOUSLY This four station special Rigidmil machines magnet frames in the following sequence: rough boring at station 1, face milling at station 2, finish boring at station 3, and loading and unloading at station 4.

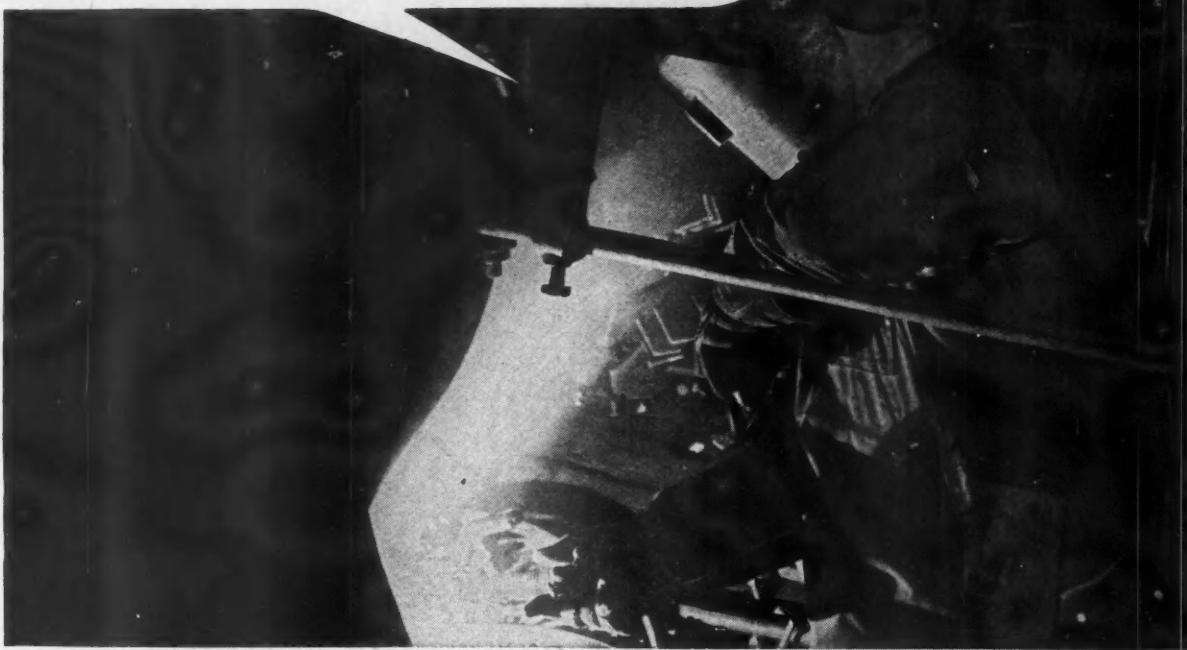
This machine replaces a conventional multiple tool lathe and, in addition, includes a milling operation.

The machine cycle consists of rapid approach, feed, dwell and rapid return automatically. The cycle is timed and interlocked with the 90° indexing fixture which presents the work in exact relation to the tools. No relocation or repositioning of the part is required. Various models of magnet frames are accommodated on this one special Sundstrand Rigidmil.



FREE ADDITIONAL DATA: Write for more proof of the successful application of Sundstrand "Engineered" milling production. This new 40 page book contains over 35 actual problem solutions together with interesting tooling diagrams. Write for your copy today. Ask for bulletin No. 266.

"Boy...Airco No. 375 is one sweet electrode!"



**"... it helped us cut press 'down time'
in our plant below two hours"**

... says one of the welders at Merchants Despatch Transportation Corporation, East Rochester, N. Y.

He explained: "A cast iron press frame cracked at the base, and was put out of operation. To replace the base meant dismantling the whole machine . . . purchase of a new base . . . and reassembly. But, using Airco No. 375 electrodes, we quickly repaired the cracked base by welding. There was no need to dismantle the press — welding permitted repair with the base in position. The entire repair job was completed within two hours." — High praise for the new Airco No. 375.

This all-position, AC-DC electrode produces machinable welds of high tensile strength and great ductility.

Smooth flowing, this exceptional electrode will take a multiple pass without separating or pulling away from the cast iron. It is recommended for, and has produced excellent welds on, cylinder blocks and heads, bearing blocks, machine parts, large frames, castings, and similar repair jobs.

Headquarters for Oxygen,
Acetylene and other Gases . . . Carbide . . . Gas Welding and Cutting
Apparatus and Supplies . . . Arc Welders, Electrodes and Accessories

But try this NEW electrode yourself — AT OUR EXPENSE! Send in your request for a FREE sample to: Air Reduction, General Offices, 60 East 42nd St., New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, General Offices, Houston 1, Texas. Represented Internationally by Airco Export Corporation.

Mail coupon today for your free sample of Airco No. 375!

AIRCO AIR REDUCTION
Offices in All Principal Cities

AA

AIR REDUCTION
60 East 42nd Street
New York 17, N. Y.

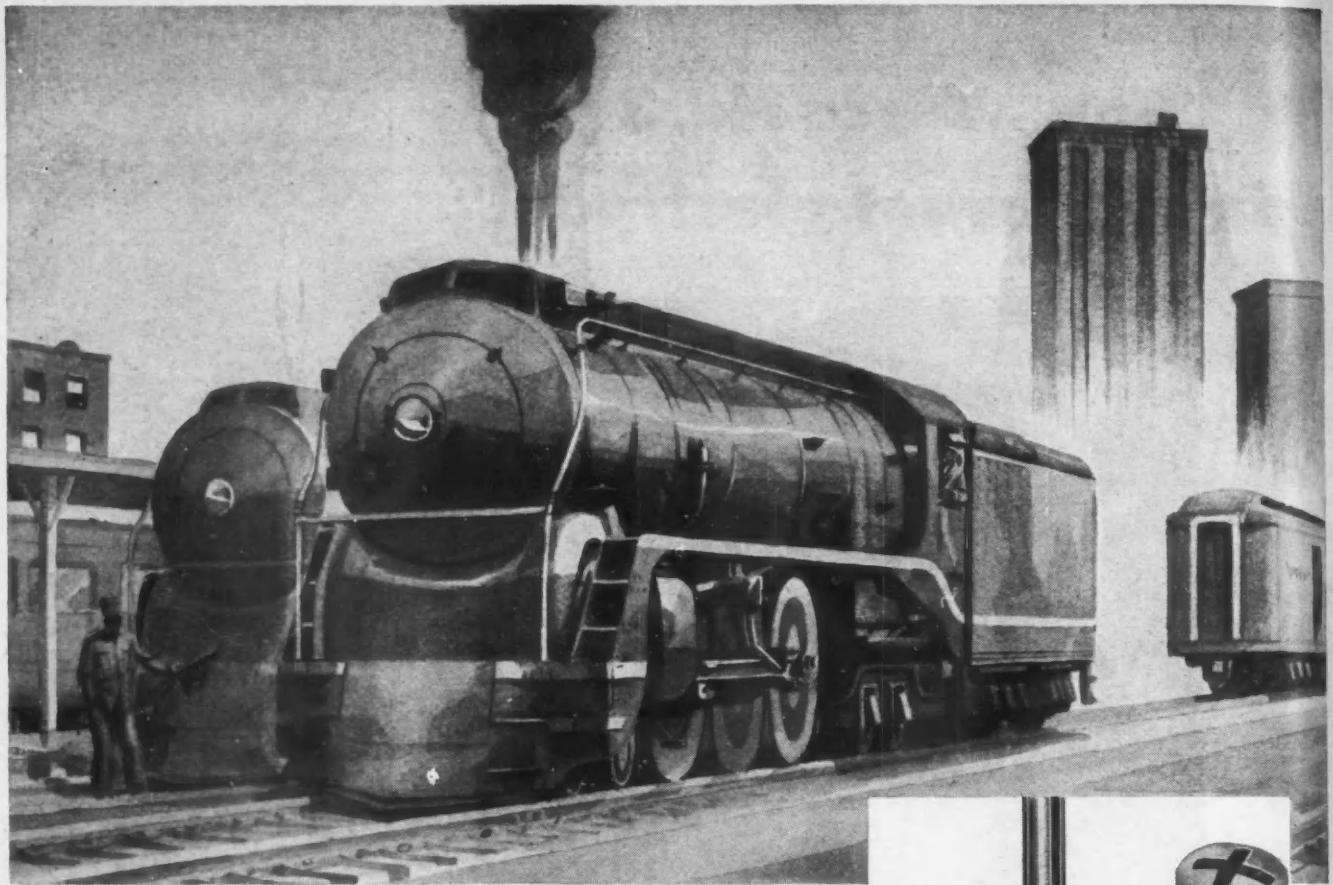
Please send me a FREE sample of the NEW Airco No. 375.

Name _____

Company _____

Address _____

City _____ Zone _____ State _____



**WHEN YOU HAVE TO CHANGE "DRIVERS"
... YOU WASTE TIME**

High-speed railroading on crack cross-country trains requires frequent changing of "drivers"—the huge locomotives that furnish the driving power. Each change of "drivers" means time wasted.

Modern streamline assembly work also involves high speed, but there is no time wasted changing drivers when Reed & Prince equipment is used. Why? Because

**ONE REED & PRINCE DRIVER FITS ALL
SIZES OF REED & PRINCE SCREWS AND BOLTS**

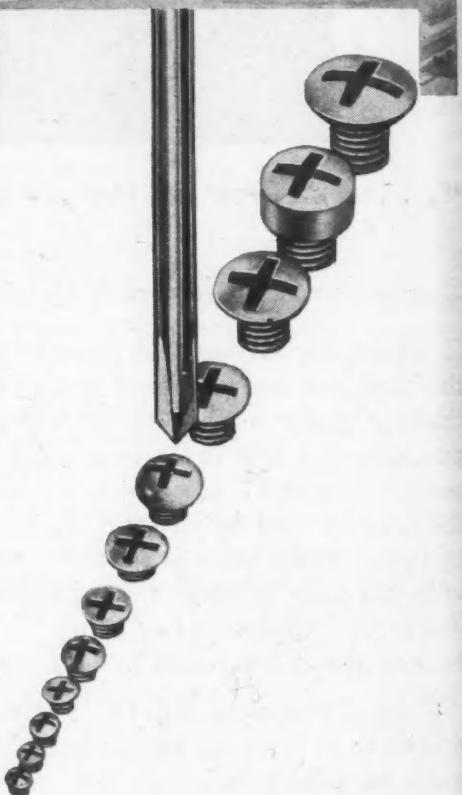
There is no longer any need to stop work, search for another driver, change to it, whenever there is a change in screw sizes. The Reed & Prince ONE driver method is the fast efficient time-and-money-saving method of modern production.

All recessed head screws and bolts have definite advantages over the older slotted head, but the Reed & Prince type Recessed Head is the only one which can be fitted and driven throughout the entire size range with a single driver.



REED & PRINCE MANUFACTURING CO., Worcester, Mass. and Chicago, Ill., manufacturers of

Recessed and Slotted Wood Screws, Sheet Metal Screws, Machine Screws, Stove Bolts. Also Cap Screws, Set Screws, Machine Screw Nuts, Wing Nuts, Rivets and Burrs, Rods, Screw Drivers and Bits, Specialties.



REED & PRINCE
Recessed head
SCREWS

Dynamatic Drives for Slow, Smooth Starts and Constant Tension

Dynamatic electro-magnetic drives, brakes, and couplings can be applied to any shaft in any type of machine to transmit motion or braking action from one rotating member to another without

mechanical contact, friction, or shock, and under complete control. Particularly adaptable to draw-benches, wire-drawing machines, plastics extruders, and so on. Inquiries invited.

C O R P O R A T I O N • KENOSHA, WISCONSIN

Subsidiary of **EATON MANUFACTURING COMPANY** Cleveland, Ohio



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Spongex is used today for hospital pads and bath sponges, chair cushions, furniture upholstery, shoe insoles, typewriter pads, auto window strips, insulation, refrigerator and door gaskets — an infinite number of things — and increasing almost daily.

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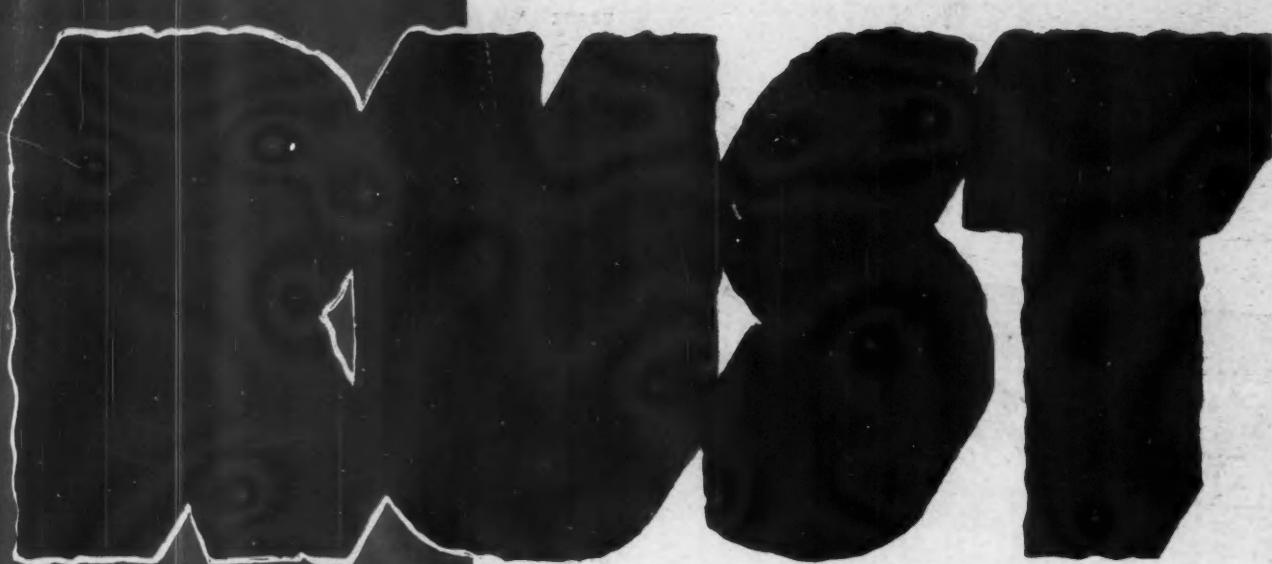
Whether you're planning improvements in your present products or developing new ones for the future, *Spongex* merits your most serious consideration. Write us describing your individual requirements. Sponge Rubber Products Co., 267 Derby Place, Shelton, Conn. Sales offices in principal industrial centers.

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Today, as a result of valiant aid given Uncle Sam in the form of inhibited oils, solvents and greases, we have selected nine of our best preventives to lead the peace-time fight. All of them were proved "under fire"; each has a use in industry's need to protect metal surfaces. Here they are:

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COSMOLINE 110-D—Dry Film Non-Removable; clear resin varnish. (USA-3-182)

COSMOLINE "B"—Dry Film, waxy type.

COSMOLINE 915—Solvent type, light oil film (52C18 Gr. II)

COSMOLINE 266—Finger-print Neutralizer; water-displacing.

COSMOLINE LIGHT—Inhibited SAE 10 oil (AXS-934 Gr. I)

COSMOLINE MEDIUM—Inhibited oil, Vis. 100-125 @ 210° F. (AN-VV-C-576 B. Type 1)

COSMOLINE HEAVY—For long-term storage.

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• Details of the HYDROL Speed Circuit are given in Catalog H-47 as well as full data on other features of Verson Hydraulic Presses. Ask for a copy.

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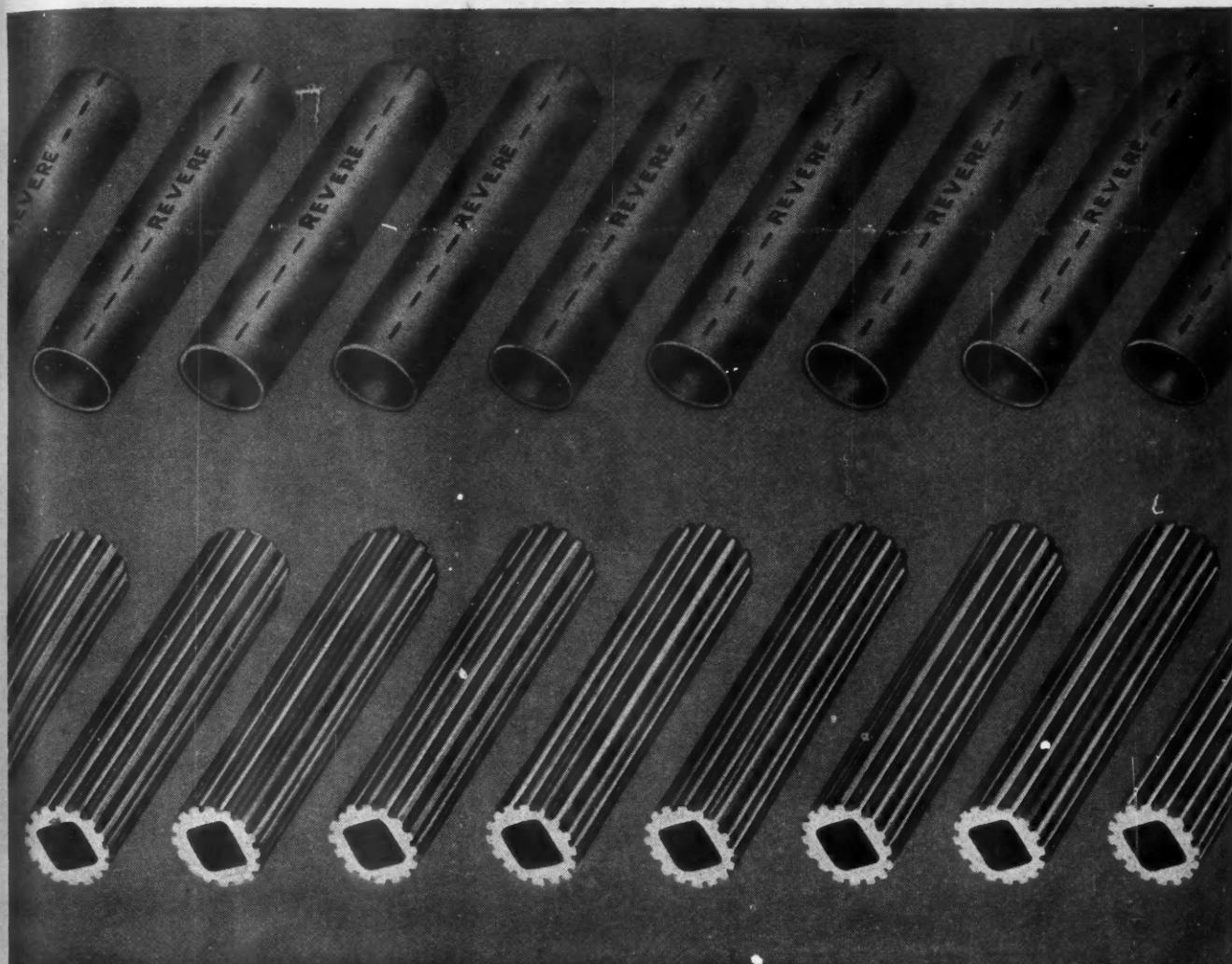
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Revere produces aluminum alloy tubes in sizes up to about $3\frac{1}{2}$ " O.D. and in many wall thicknesses. The alloys available are 2S, 3S, 4S, 24S, 52S and 61S.

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The Revere office nearest you will be glad to give you more complete information about Revere aluminum alloy tubes and extruded shapes as well as technical assistance in their application.

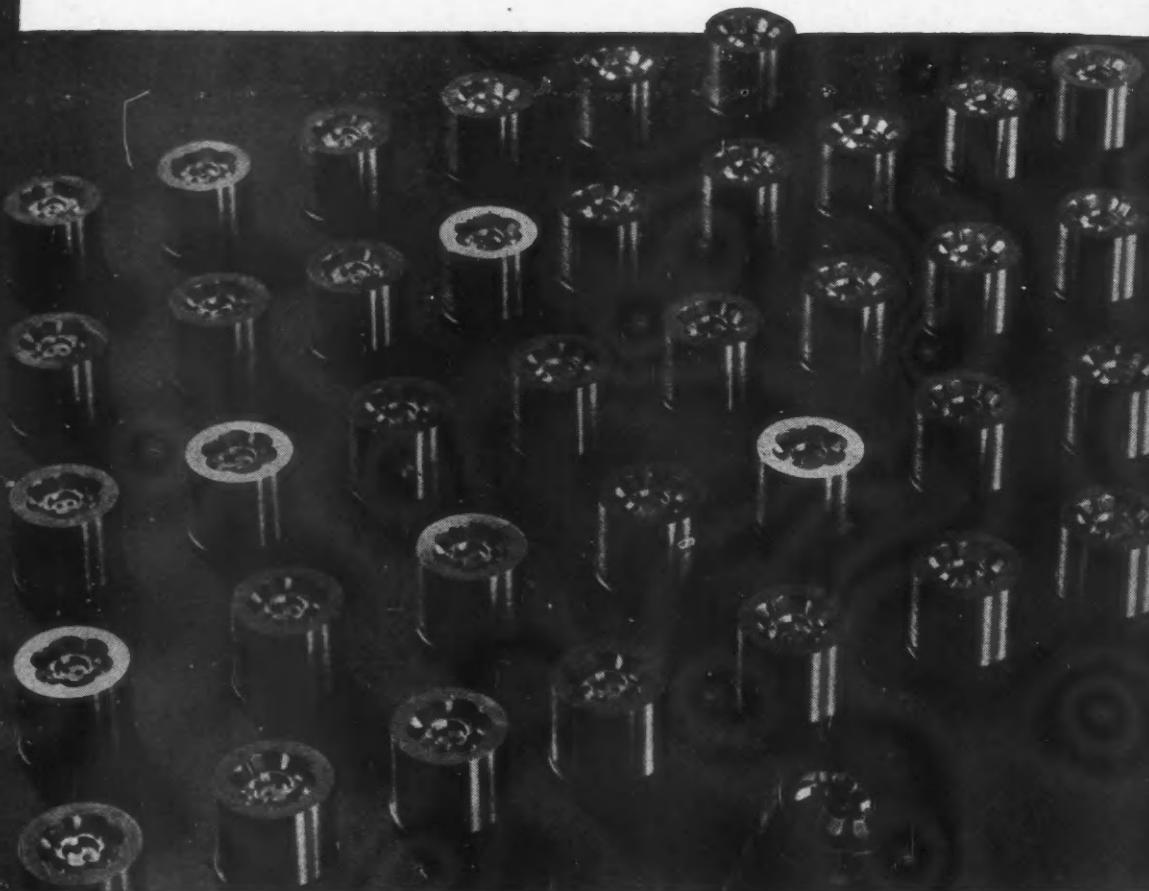
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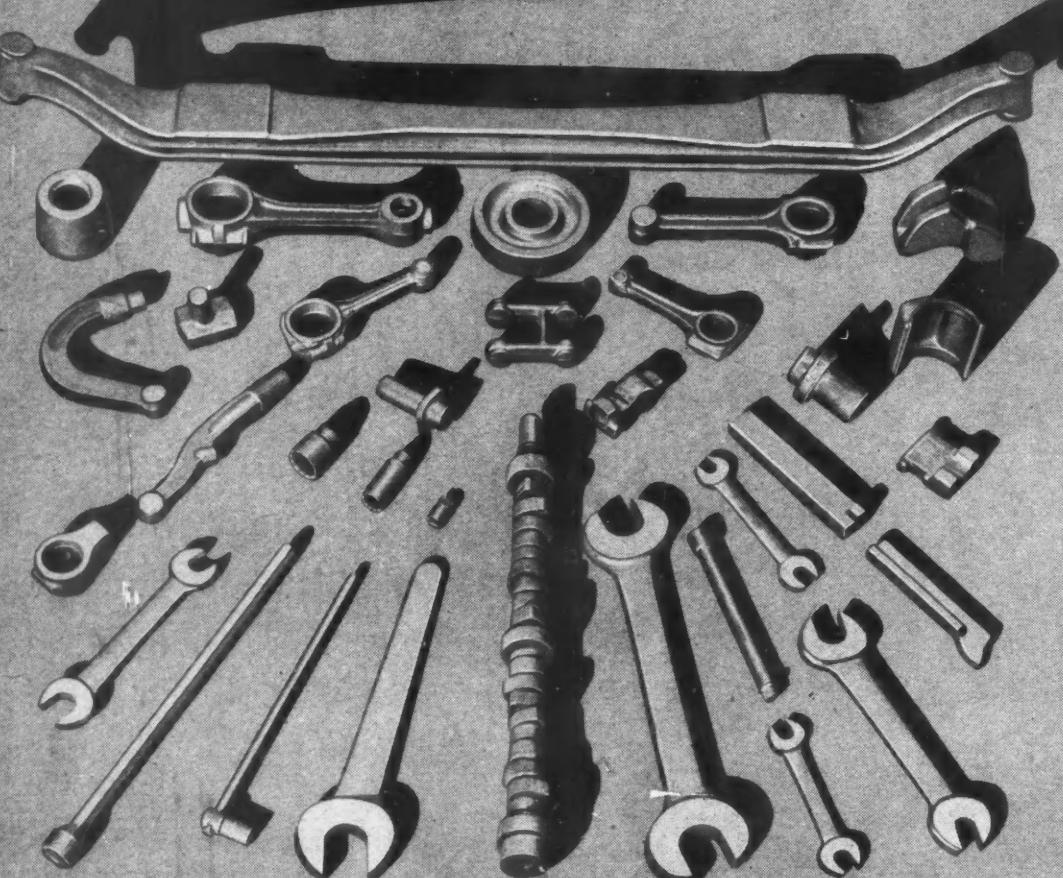


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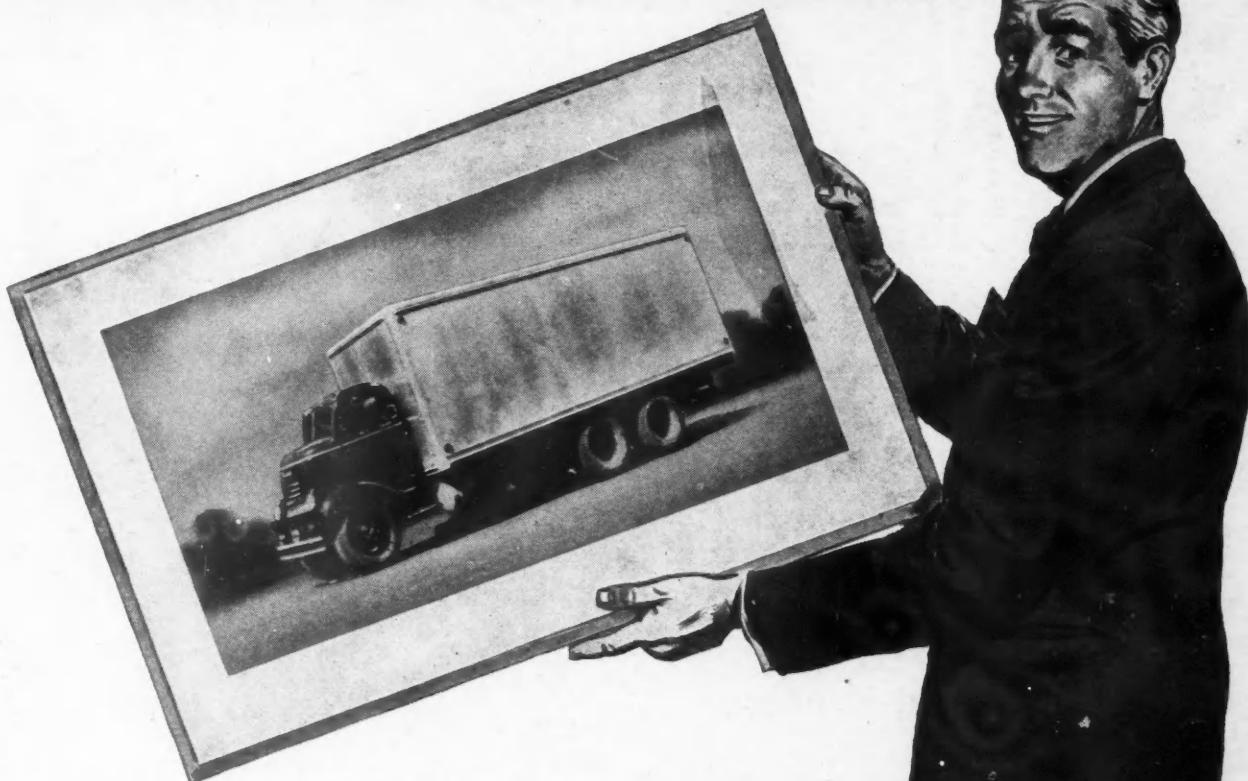


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Yes, there are many factors that go to make up the true cost of aluminum. Failure to consider them all may be costing you the benefits of this modern metal. Reynolds technicians will welcome the opportunity to work with you in the use of aluminum for the betterment of your products and profits. For complete information contact your local Reynolds Sales Office or write Reynolds Metals Company, 2513 South Third Street, Louisville 1, Kentucky.



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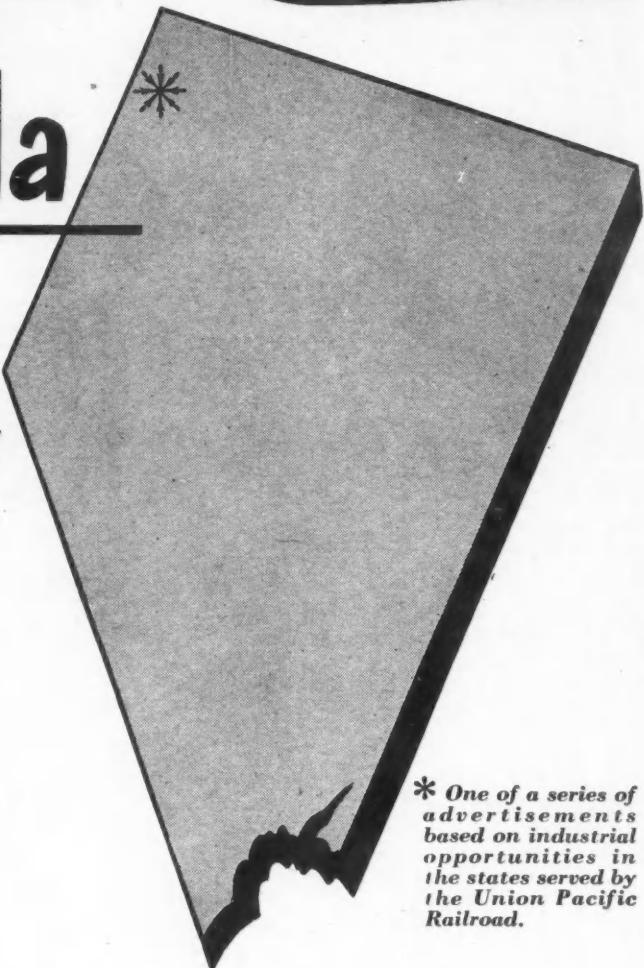
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- Variety of metals, minerals and ores of value to industry
- Power and irrigation projects
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- Excellent rail transportation



* One of a series of advertisements based on industrial opportunities in the states served by the Union Pacific Railroad.

Manufacturers, packers and processors will find Nevada a storehouse of raw materials. There are deposits of copper, silver, gold, zinc, lead and uranium. Mineral ores and minerals include tungsten, manganese and antimony ore, magnesite, gypsum, sulphur, borax and vanadium. Building stone and marble also are available. Cattle, sheep and poultry raising are expanding agricultural pursuits and there also is some

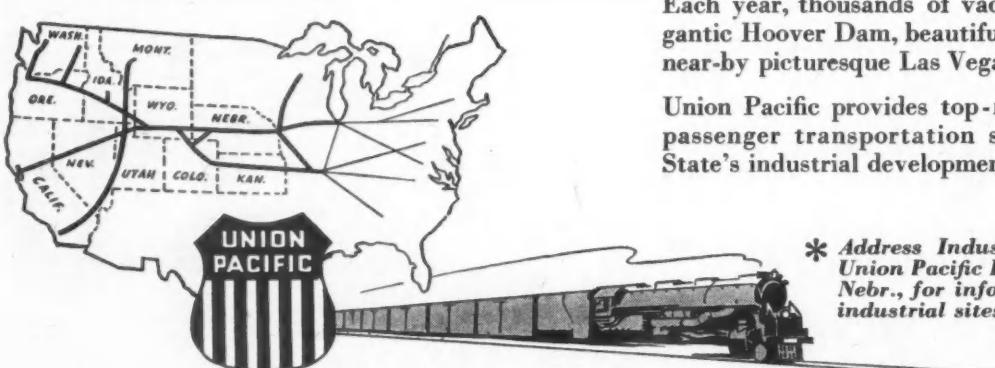
production of a variety of grains, vegetables and fruits.

Irrigation and power are supplied by several Federal projects including famous Hoover Dam.

Nevada's healthful climate, excellent educational system, and a variety of scenic attractions contribute to the advantages of living in this western area.

Each year, thousands of vacationists visit gigantic Hoover Dam, beautiful Lake Mead and near-by picturesque Las Vegas.

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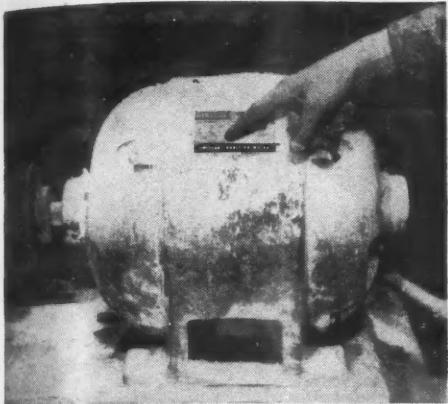
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Keeps Its Bearings in "Dust Bowl"

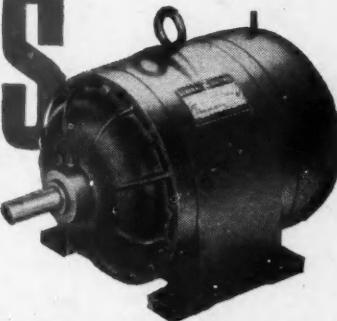
Ordinarily, we wouldn't recommend that you use an open motor on a job like this. This Tri-Clad motor drives a boiler-feed pump in the National Gypsum Company plant at Clarence Center, N. Y. The air surrounding the motor is constantly filled with gypsum dust which must be kept out of the bearings. And it *has* been kept out of the bearings of this Tri-Clad motor, thanks to its specially designed bearing housing and seals. We believe that the Tri-Clad motor you see here proves that even where dust, moisture, or some other hazard is extremely severe for open-motor applications, the extra protection afforded by Tri-Clad motor construction results in longer motor life and lower upkeep.

The toughest motor yet!

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- A cast-iron, double-wall frame which completely encloses and protects the windings and punchings.
- A nonshrinking compound around motor leads which protects motor interior from dust and moisture.
- A rotating labyrinth seal which further protects the motor interior from damage by foreign matter.

ON 1,220,000 MOTORS



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Rigid cast-iron frame and end shields protect vital parts from external abuse and prevent resonance. Because they're not at the mercy of a coat of paint, they strongly resist chemical attack and dampness. Cast iron also gives you tight, metal-to-metal fits between end shields and frame.

EXTRA PROTECTION ... AGAINST ELECTRICAL BREAKDOWN

Windings of Formex* wire together with improved insulating materials, reduce the chances of electrical failure. Heat is dissipated quickly — motor stays young for years and years.

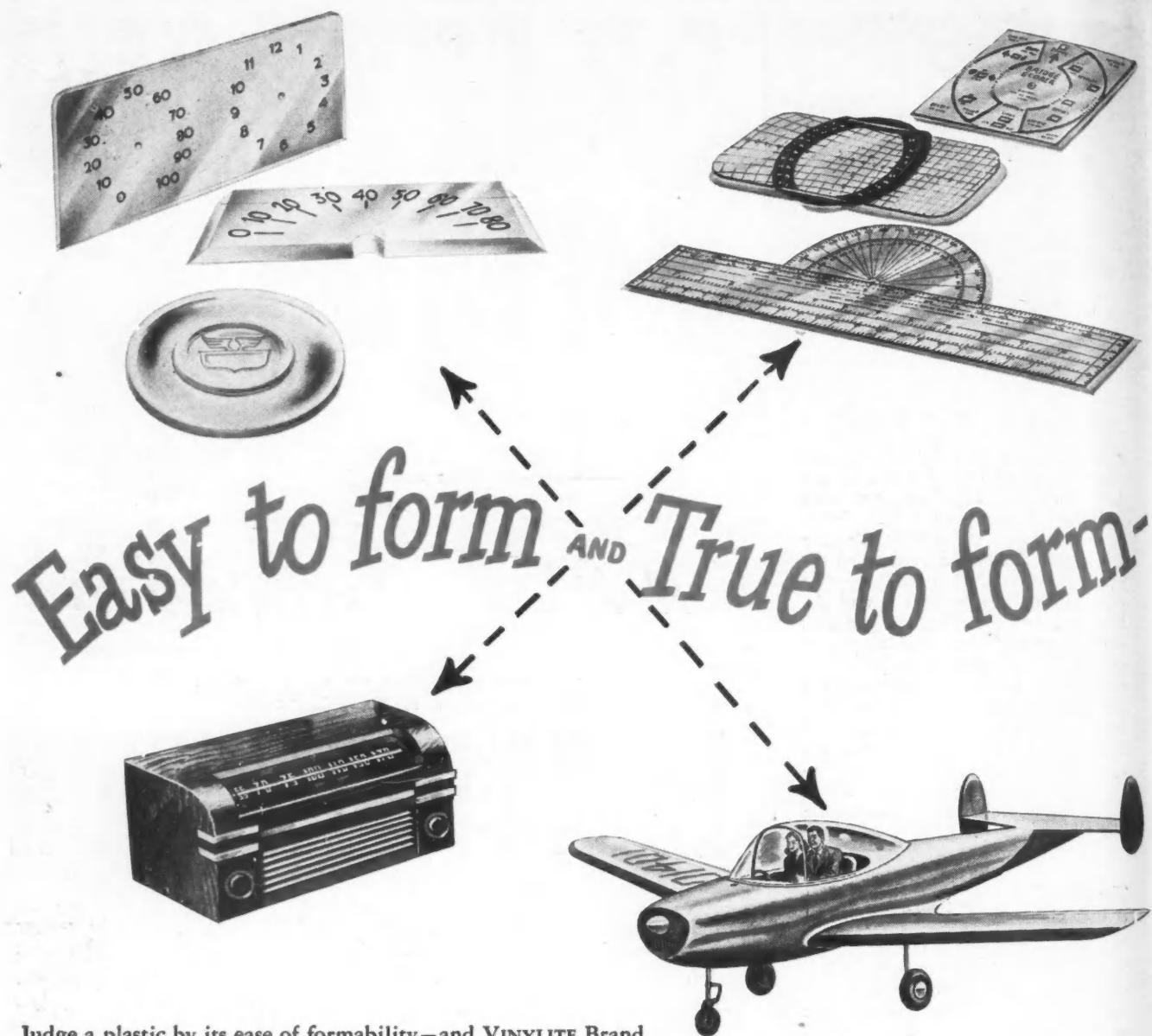
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Bearing design affords longer life, greater capacity, improved lubrication features. Bearing seals retain lubricant, keep out dirt. One-piece, cast-aluminum rotor is practically indestructible.

*Trade-mark reg. U. S. Pat. Off.


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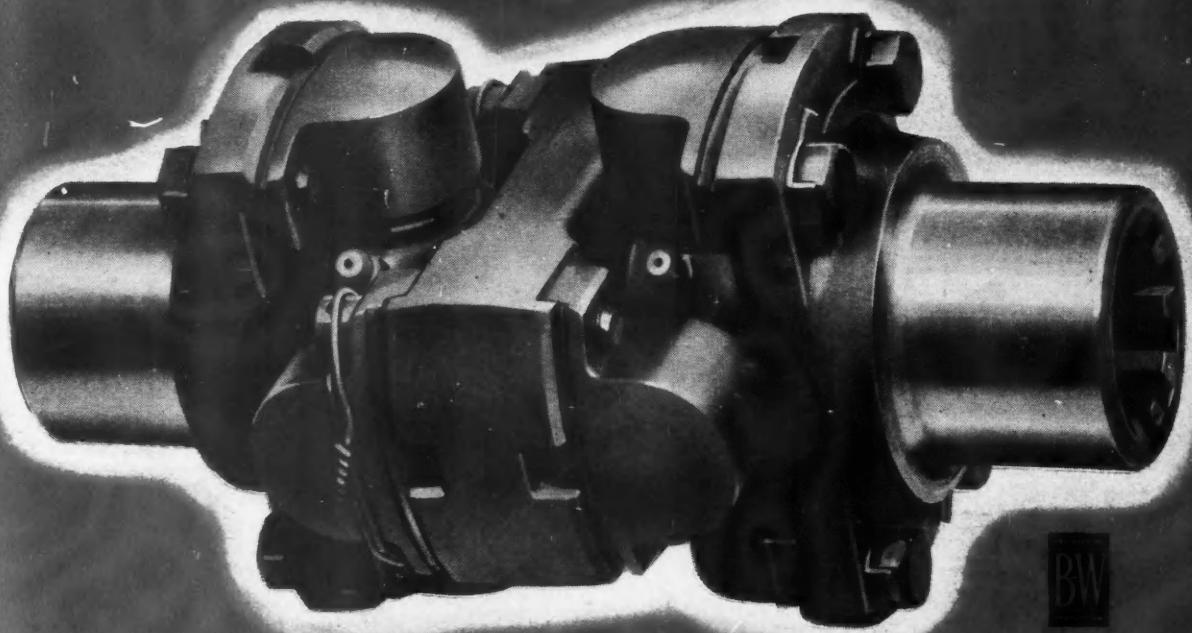
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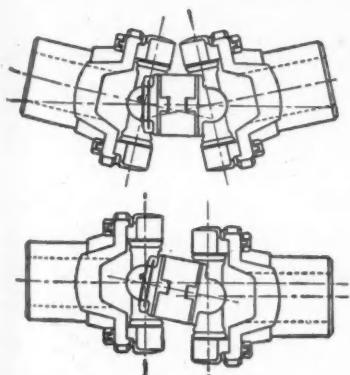
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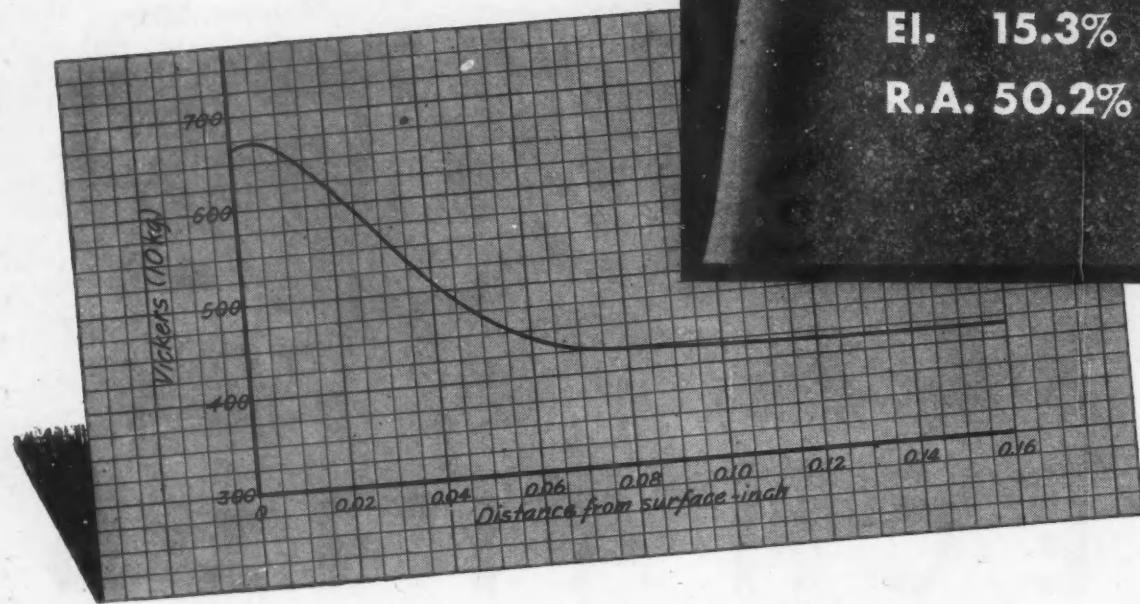
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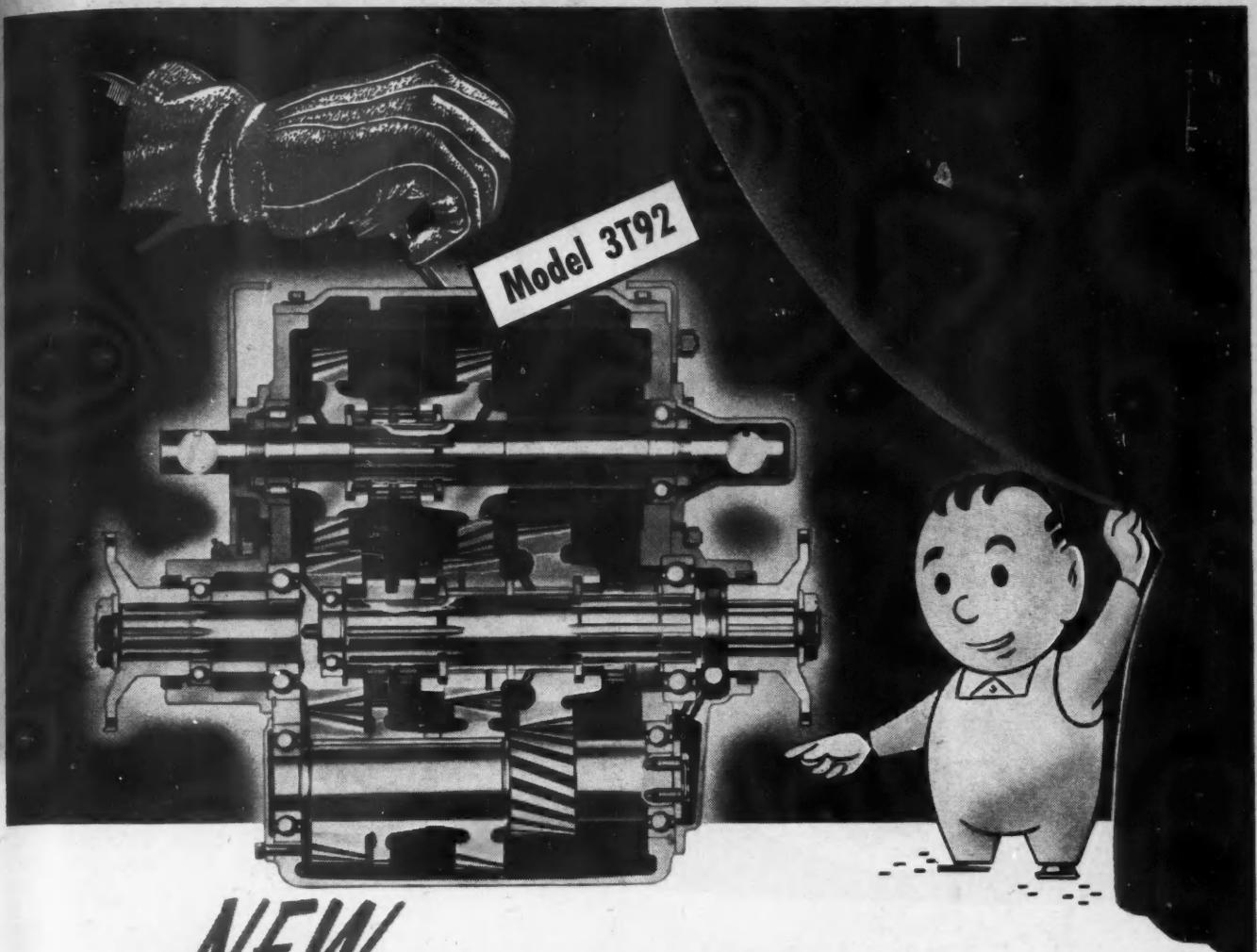
acteristic of all vanadium steels, and the firm integration of case and core are clearly shown in the macrograph.

The strong bonding is also graphically presented by the chart, which shows the gradual decrease in carbon penetration from case to core.

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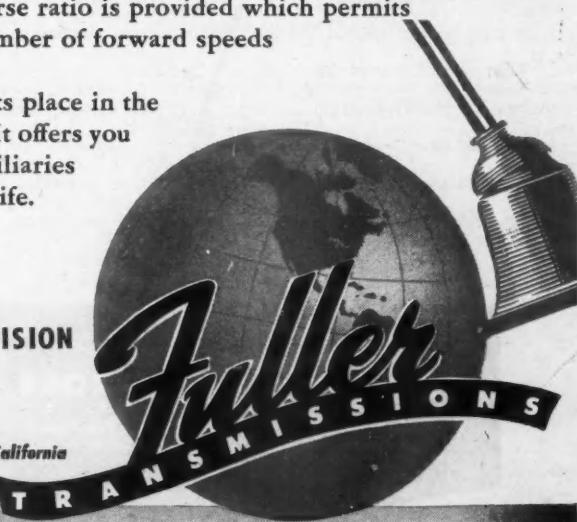
The Model 3T92 Fuller Auxiliary Transmission takes its place in the Fuller line after three years of thorough testing in the field. It offers you the usual characteristics of Fuller Transmissions and Auxiliaries . . . including superior, quiet performance and long wear-life.

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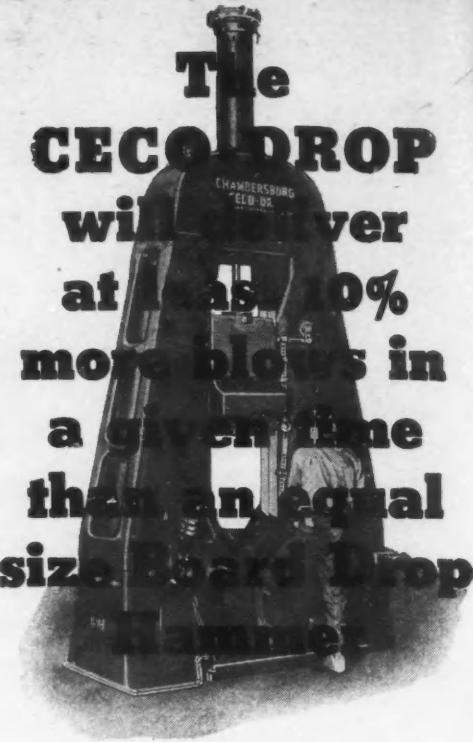
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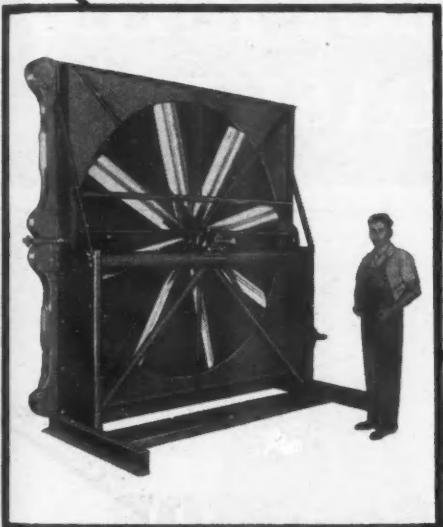
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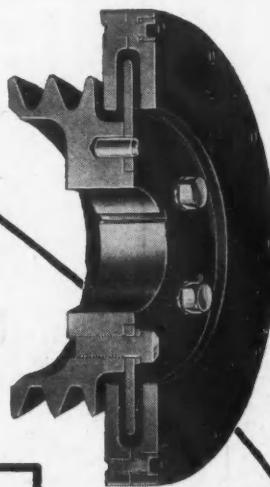
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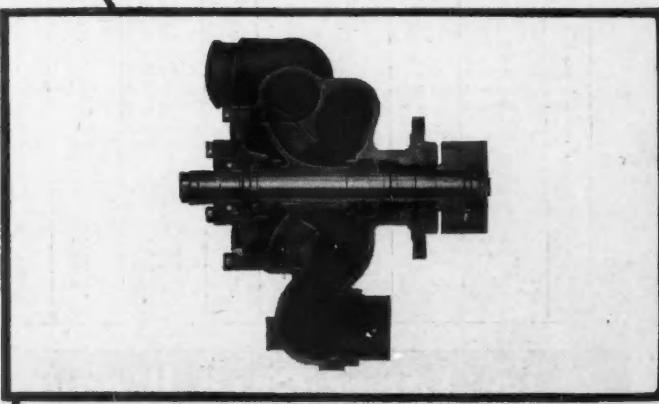
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(Cutaway view) Water Pump for 280 HP Diesel engine showing bearing and automatic shaft seal construction.

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(SOME RATIOS IN STOCK)

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Worm Gear Speed Reducers

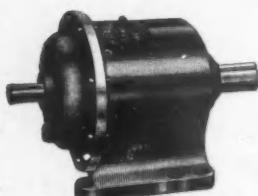
SIZE	QUANTITY	RATIO	INPUT H.P.	RATING AT 1750 RPM	RATING AT 1150 RPM
SIZE	73	5 1/6 to 1	3.3	.26	
	143	10 to 1	2.5	.2	
	15	15 to 1	1.85	1.5	
	51	20 to 1	1.4	1.1	
	9	25 to 1	1.0	.9	
	74	30 to 1	.97	.78	
	150	40 to 1	.74	.60	
	73	50 to 1	.63	.50	
	50	60 to 1	.50	.39	
3-3/4 HT	5	5 2/5 to 1	5.7	4.7	
	3	7 to 1	4.8	3.9	
	16	10 to 1	4.4	3.3	
	26	14 1/2 to 1	3.2	2.5	
	9	20 to 1	2.4	1.9	
	43	30 to 1	1.7	1.34	
	24	40 to 1	1.22	1.00	
	25	50 to 1	1.05	.84	
	90	60 to 1	.85	.68	
GYR or MA	3	5.8 to 1	6.5	5.5	
	10	10 to 1	4.56	3.72	
	13	16 1/2 to 1	3.2	2.63	
	25	20 to 1	2.06	1.8	
	50	30 to 1	1.93	1.56	
	2	40 to 1	1.47	1.21	
	23	45 to 1	1.31	1.08	
	48	60 to 1	.99	.81	



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SIZE	QUAN.	RATIO	INPUT H.P.	RATING AT 1750 RPM	RATING AT 1150 RPM
G-7½	16	24 to 1	.87	.68	
	9	30 to 1	.65	.50	
	13	40 to 1	.48	.38	
	1	50 to 1	.39	.30	
	4	56 to 1	.35	.27	
	10	60 to 1	.33	.25	
	4	80 to 1	.26	.20	
	4	100 to 1	.20	.16	
	5	120 to 1	1/6	1/6	
	3	200 to 1	1/6	1/6	
	2	408 to 1	1/6	1/6	
	4	400 to 1	1/6	1/6	
G-15	7	30 to 1	1.3	.95	
	9	40 to 1	.96	.74	
	4	50 to 1	.77	.58	
	25	60 to 1	.65	.47	
	3	81-3/5 to 1	.50	.36	
	55	120 to 1	.33	.25	
	1	140 to 1	1/4	1/4	
	1	360 to 1	1/4	1/4	
G-25	8	40 to 1	1.5	1.	
	9	50 to 1	1.25	.94	

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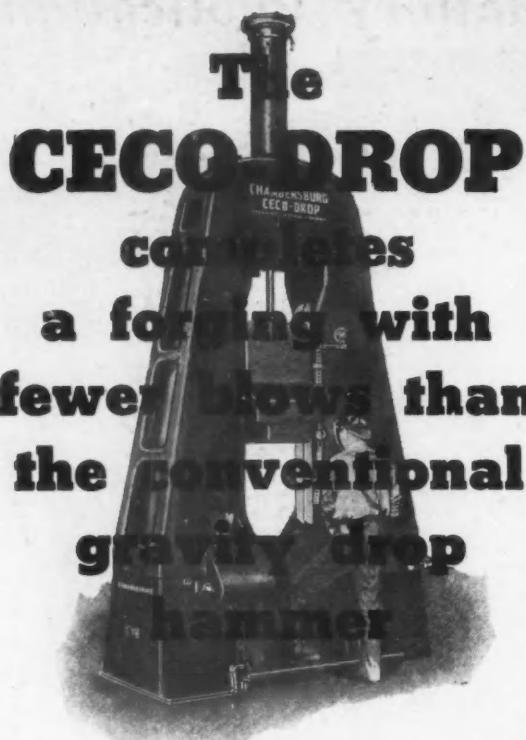
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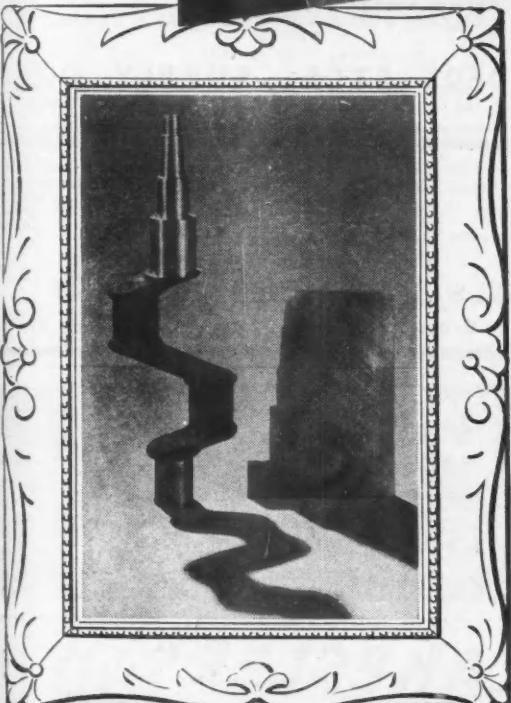
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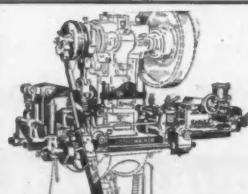
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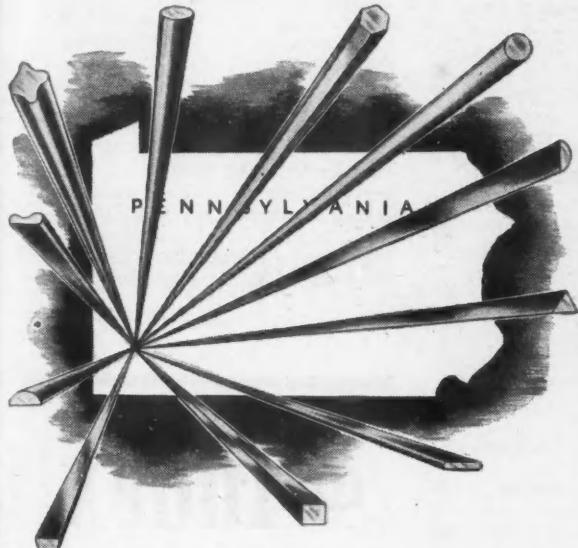


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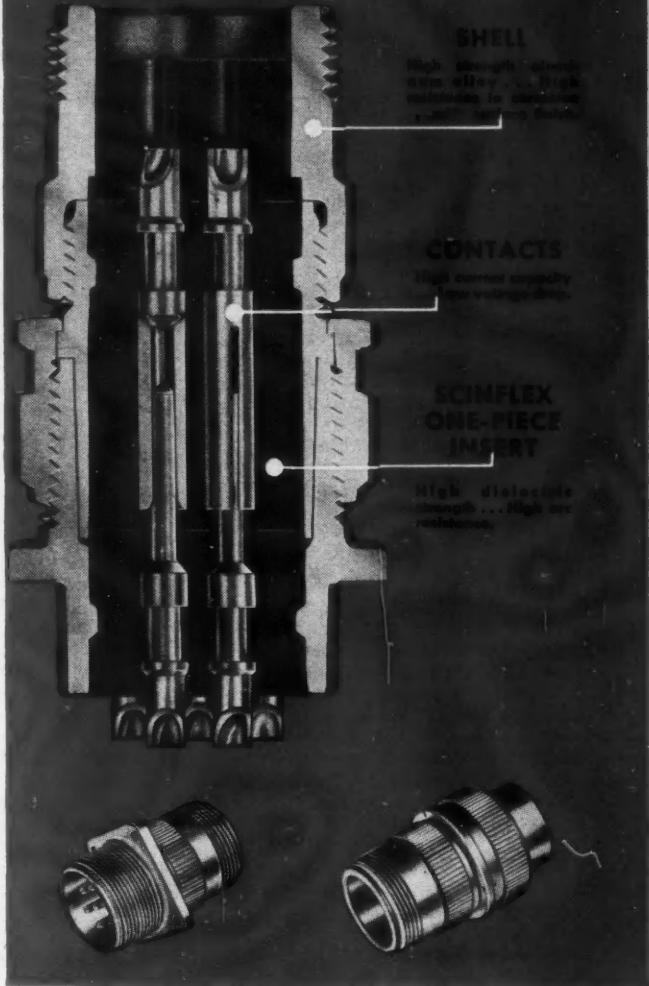
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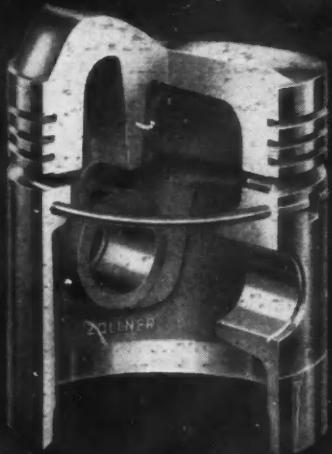


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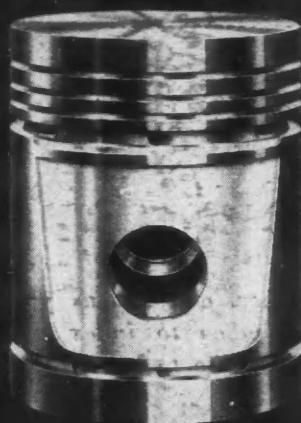
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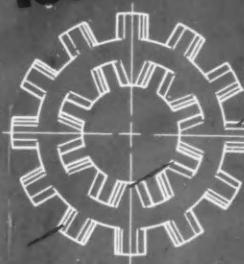
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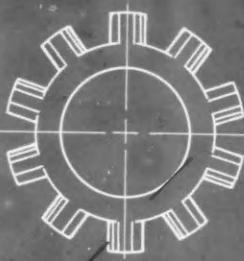
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flexed under pressure**

GRIP FOR KEEPS

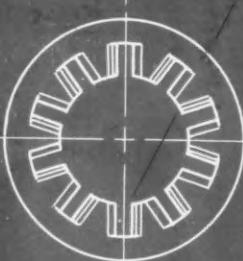
**wherever positive
locking is vital**



INTERNAL-EXTERNAL



EXTERNAL



INTERNAL



EXTERNAL COUNTERSUNK

Ever **LOCK**
WASHERS
THE WASHER THAT HAS THE EDGE

This patented design is exclusive to EverLOCK. The numerous tongues, the wide chisel edges of which are bent alternately up and down, provide several times more gripping area than other lock washers. The alternating chisel edges, forced into the contiguous faces of both work and nut by powerful spring tension, provide a 2-way locking action that defies every conceivable loosening hazard. That's why you'll find EverLOCK washers guarding vital assemblies on so much heavy machinery, electrical appliances, automotive and aviation equipment.

THOMPSON-BREMER & CO., 1642 W. HUBBARD STREET, CHICAGO 22, ILLINOIS

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another
mass
production
problem

SOLVED

3600

pistons classified per hour

Shock absorber pistons come by conveyor from the centerless grinders to this Sheffield "Airlectric" Automatic Gaging Machine for inspection and dimensional classification.

The operator merely feeds the pistons into a chute. The "Airlectric" then automatically segregates undersize and oversize units. At the same time, those which fall within toler-

ance limits are separated into five classifications for subsequent selective assembly—and at the rate of 3600 units per hour.

If you require accurate inspection on large volume production, you can make material savings with machines similar to that described here. Check with Sheffield on multiple and automatic gaging problems.



the *Sheffield* corporation

Dayton 1, Ohio

U. S. A.

{ Standard Gages
Shipped in 24 Hours }



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